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VOL. 60 OCTOBER, 1948 No. 4

THE ROLE OF RADIOLOGY TODAY, ITS RESPONSIBILITY AND ITS IMPORT UPON OUR LIFE*

By LAWRENCE REYNOLDS, M.D.

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THIS Society has honored me far beyond my deserts. To be elected President of the American Roentgen Ray Society is an honor to be coveted, for is it not the oldest radiological society in this country, with a long array of brilliant scientific contributions and an unrelenting effort of well nigh fifty years, which, today, places it in the fore-front of accomplishment. It has not yet reached the fixed period; indeed, medicine never reaches that period of existence.

I shall not attempt to discuss the historical backgrounds of our Society; there are men in this audience who have seen it grow from the beginning and, therefore, as Aristotle says, "He who sees things grow from the beginning will have the finest view of them." I am one of the lowly ones and from that point of vantage I would like to discuss radiology's role today, its responsibility, and its import upon our life.

Medicine is a vessel which has been replenished from the treasury of enlightened minds. and when Röntgen poured his new kind of ray into this vessel little could he imagine the important effect on the world of science and the remarkable train of scientific events that have so closely followed. That branch of medicine known as radiology must boast that it more nearly approaches the example of Holmes' Chambered Nautilus for did it not begin as a unicellular plant, which could scarcely be dignified in those early days as a department, in some neglected room in the basement of the hospital. The early workers, by dint of sheer determination against all sorts of adversity and discouragement have elevated it from there to the high place it occupies in the hospital organization and in the practice of medicine. Today radiology stands at the crossroads of the corridors of the hospital forming the keypoint from which knowledge is disseminated in many directions to the benefit of the patient and to the advance of medical progress. We owe a great debt to those who blazed the trail and laid the pathway over which we late comers travel so easily.

Who are these men of radiology who have contributed so fruitfully to its advancement? Many of them were members of this Society; members whose lives and work are

* President's Address delivered before the Forty-ninth Annual Meeting, American Roentgen Ray Society, Chicago, Illinois, September 14–17, 1948.

now matters of history—Williams, Caldwell, Dodd, Carman, Crane, Hickey, Pancoast, Ruggles, Baetjer, Manges, Pirie. Others are still with us to remind us of the youthfulness of our branch of medicine—Case, Cole, Percy Brown, Pfahler, Christie, Holmes, Stewart, Potter, Grier, Nichols, and a whole host of younger men whose names and works are familiar to all of us. These men and others like them have set the pattern for radiology; they are men steeped in the knowledge of medicine in general and their specialty in particular. Men who are wise in counsel and considered in their judgments; original and ingenious. They had to be. Were they not dealing with a wholly new instrument in diagnosis and therapy in a domain where there was no well ordered road map of experience to guide them? Men who have given and given freely of their knowledge and time that the science of radiology might advance. Many have been teachers of rare ability, leaving a school of younger men as an example of their instruction. If one would consult the bibliography of radiology, here he would find their names writ high in the worthwhile contributions on the most varied subjects. These men took the faint flicker on the fluorescent screen in Röntgen's laboratory and transmuted it into the fine profession which we know today.

The whole history of radiology from its incipiency to the present time is one of steady development. Perhaps no single episode which has resulted from a scientific endeavor has so greatly influenced the progress of the human race as the discovery of the roentgen ray and radium and there is no branch of medicine which has not benefited by their employment.

This places radiologists in a very privileged and enviable position. We must not be content merely to carry out the daily routine in our departments but we must devote some of our thought to the care of the patient of tomorrow. As physicians who have been in the vanguard of the advancement of modern physics, we now must take our share of responsibility in furthering new research methods for future investigations. Are we not in daily contact with the pathological processes, the unraveling of which gives an impetus to our imagination and to our endeavor? All too often a radiologist of splendid scientific ability finds himself engrossed in matters of administrative interest losing sight of the fact that the greater importance lies in the experimental approach toward the solution of some of the problems of disease which man is heir to.

To maintain high standards in a radiologic department, enough sufficiently trained associates must be available to share the burden of the routine. The radiologists themselves should be responsible for a thorough examination of the patient. The custom of delegating the radiographic work to technical assistants does not always serve the best purpose. There may be minimum requirements in a certain case calling for a set procedure, but the maximum requirements should be determined on the basis of the individual clinical findings. It is the duty of the radiologist to help arrive, if possible, at the proper diagnosis. To this end no effort should be spared. Too long has the radiologic department been the arena in which the economic battles of the hospital are fought. A much wiser course would be to let the accrued money remain in the department so that additional well trained men may be secured and technical equipment of the latest design obtained, thus insuring the best care of the patient.

We also must exert wisdom in the selection of the young men who come into the radiologic department for training. Each year medicine recruits into its ranks the very flower of our young manhood. These in turn enter our hospitals as interns and residents. From them we must choose the future radiologists. If we are to secure the best, it is important that we select men of high character, great intellectual ability, a

desire to work, and those who believe in the dignity of work; men who are willing to scorn delights and live laborious days—not men who are merely content to "toddle to a competancy." In short, superior, worthwhile men in medicine who have the vision to see the great future that lies ahead in radiology and its allied sciences. The late Dr. Manges said shortly before his death that he wished he were "a young man again just entering radiology"—a fine tribute to his branch of the profession to which he had himself, contributed so much.

The training of a radiologist you will hear discussed tomorrow evening* by one who is steeped in the knowledge of that subject.

Cannot radiology boast that it spawned other exciting and important professions—namely, aviation chemistry, radiotherapy, radiochemistry, atomic radiology, structural atomic radiation engineering; none of which would be if Röntgen, the Curies and Sir J. J. Thomson had not accelerated by leaps and bounds new knowledge in the world of charged particles.

History records the ebb and flow of civilization which led at last in the great days of Greece to the beginnings of science. "To one small people it was given to create the principle of progress; that people was the Greek. Except the blind forces of nature, nothing moves in this world which is not Greek in its origin," and Cournot, speaking of the atomic theory, says that "none of the ideas that antiquity has bequeathed to us has had a greater or even a similar success." Modern atomic theory is but the lengthening shadow of Leucippus and Democritus and our recent advances in the exploration of the atom is but an extension of their well ordered theory. And it was Pierre Gassendi, the French Dean and Prebendary, who finally introduced atomic theory into modern physics. So the atomic theory looks back on a long and eventful history culminating in the fall of the atomic bomb on Hiroshima and Nagasaki. We have reached the age of atomic fission which has given rise to a new science of non-static biology which, as Warren says, calls for revived concepts if man is to cope adequately with the perils of atomic warfare and to exploit radiation.

We have entered new fields of scientific investigation involving to a great degree relativity rather than the absolute with which scientists were accustomed to deal and as a result of the application of atomic fission in medical research science has come to regard the human being as an exquisitely constructed physiochemical mechanism, and among the most significant of its discoveries are those which are revealing the operations of man's bodily machine. The accumulated evidence from biology and the medical sciences shows that each of us is a biochemical system, elaborate beyond the ability of science to analyze as yet. No longer can the human body be considered as static and precise but as dynamic and constantly changing. So the day of human exploration has begun utilizing the most modern of physical and chemical methods. And we are told in flaming headlines that microbes are being pounded by radioactive atoms in an attack on the secrets of life's beginnings, and the work is starting with a microbe known as *E. coli*, one of the most common forms of bacteria, and an organism or one very closely resembling it, which came into existence about five hundred million years ago.

The products of atomic fission are being used to discover how the human body converts food into fat, flesh and energy and how it repairs injuries and how radioactive isotopes seek out specific tissues and flood them with rays which in some cases have extraordinary healing power, and the biologists are using them in other scientific efforts to catch the green leaf in the very act of making starch, sugar and cellulose with the aid of the sun. By the use of the products of atomic fission great progress is being made in illuminating some of the

* The Caldwell Lecture, "Graduate Education in Radiology," by B. R. Kirklin.

darker regions of physiology and chemistry.

Not only is atomic energy being used to elucidate many unknown problems, but it is creating additional problems to be solved. For instance, the medical problems arising from the explosion of a nuclear fission bomb over a modern city will be vast to the point of being almost overwhelming at the beginning and will continue for a period of years.

Radioisotopes today in their relation to general medicine are very much in the same position as radiology was fifty years ago. It began as a tool of the physicist and by gradual expansion in its medical application it became a department within itself. Is it not logical that radiant energy should also fall within the specialty of radiology, and is not that the safest department in the hospital within which it should fall, as the hazards of atomic fission are comparable to those of the roentgen ray? Since the radiologist has learned over long experience the ill effects from unguarded radiation, might not he in that capacity be better able to safeguard not only the patient but also those working with radioisotopes?

It might be argued, and rightly so, that the radiologist is not always equipped with a sufficient knowledge of nuclear physics to carry the burden and added responsibility of this important new form of radiant energy unless he is so fortunate as to have in association with him a well trained physicist. Indeed, in a modern radiological department such an association is not only justifiable but necessary. Certainly until the radiologist of the future is properly trained in medical physics there is no alternative.

Since the government has made available, in unlimited quantities, radioisotopes both for research and therapy, there is opened up a wide field of investigation. With the generous grants that are being made both by the National Research Council and the Research Division of the American Cancer Society, grants which are made not only to the universities but to well equipped and staffed departments in some of the smaller institutions, it behooves us as a Society to see that such grants and aids are utilized to the greatest advantage. Not all of the important discoveries which have led to advances in medicine have been made in marble halls. Many of them have come from relatively obscure departments equipped for the most part with intelligence. Therefore, the National Research Council and the American Cancer Society have pursued a wise policy in the generous consideration of some of the smaller institutions. Who knows but that out of such generosity may come things of great importance! The discovery of the cause of cancer is not, as we are led to believe, just around the corner, but the vast accumulation of knowledge of the normal as well as the abnormal may ultimately lead to the clue which will unravel the riddle.

The headlong, almost untrammeled, advances of science in its search for truth has led us into perilous situations. Man himself is unable to keep pace with the advances in the scientific world, and we have become a one-sided individual. What boots it if in our scientific endeavor we are able to unravel the biological and physical aspects of man if we lose the soul itself? With the unbridled search for truth we are in the act of destroying what some call the *illusions* of life and we are suddenly faced with the stark realities, being reduced to a mere mechanism. We lose some of the finer characteristics which civilization has built up over the thousands of years and there is great need for a re-establishment of values in life. At the end of World War I Sir William Osler in his brilliant address before the Classical Society of Oxford on "The Old Humanities and the New Science" made a plea for the introduction of a study of science in the humanities in order to show the part that it played in the advancement of civilization. He pointed out that "no man is cultivated up to the standard of his generation who has not an appreciation of how the achievements of the human

mind have been reached; and the practical question is how to introduce such studies into the course of liberal education, how to give the science school the leaven of an old philosophy, how to leaven the old philosophical school with the thoughts of science."

The wheel has turned full cycle and now, at the end of World War II, the tread of the march of science has muffled to a faint whisper the Old Humanities in the corridors of our halls of learning, and we men of medicine and science must participate in the revival of the humanities, if civilization as you and I know it is to continue.

These are thoughts on things, thoughts though lightly touched upon.

TRAUMATIC BRONCHIAL RUPTURE WITH OCCLUSION*

By PHILIP J. HODES, M.D., JULIAN JOHNSON, M.D., *and* JOSEPH P. ATKINS, M.D.
PHILADELPHIA, PENNSYLVANIA

BRONCHIAL tears are not common. Usually due to crushing chest injuries, they are often fatal. When patients survive this injury, they may develop complete bronchial occlusion and pulmonary collapse.

A patient who sustained a torn bronchus with subsequent pulmonary collapse was recently examined and treated in the Hospital of the University of Pennsylvania. Whereas post-traumatic bronchial occlusion was thought of, other possibilities seemed more probable to those of us unfamiliar with the condition. When the patient was operated upon, he proved to have an occluded bronchus due to trauma.

The purpose of the present communication is to record our findings in this patient. In addition, the literature pertaining to this subject is reviewed.

CASE REPORT

G.M., male, aged thirty-six, was admitted to the Hospital of the University of Pennsylvania on February 20, 1946, complaining of severe dyspnea of two days' duration. He had been perfectly well until October 5, 1945, when he was severely injured by a racing automobile that jumped the track and entered the viewing stands. He was hospitalized immediately and was unconscious for four days.

The patient's chest was first examined roentgenographically ten days after the accident, on October 15, 1945 (Fig. 1*A*). The single anteroposterior view of the chest revealed the following: Moderate interstitial emphysema extended throughout the right lateral chest wall and into the neck on the same side. The right first rib was fractured in its paravertebral region. The trachea was in the midline. The heart and aorta seemed unaffected. The right hemidiaphragm was somewhat elevated, the left was normally placed. A pneumothorax was noted on the right side with approximately 35 per cent collapse of the right lung. The left lung was normal.

A mild cough and moderate dyspnea were noted at that time.

The patient improved rapidly. His chest was again roentgenographed on October 27, 1945, at which time the following was noted (Fig. 1*B*): The general appearance of the chest revealed considerable improvement. Interstitial emphysema and pneumothorax were no longer evident. The elevated right hemidiaphragm was still present. The lungs appeared clear. (It is noteworthy that this patient was in the Navy for two years prior to his injury and probably had a healthy chest at that time.)

Slight substernal distress and mild dyspnea persisted after the patient left the hospital in October, 1945. The dyspnea reached its peak in December, 1945, when vertigo was also noted. It was not until February 18, 1946, however, that he suffered real respiratory embarrassment. At that time, he suddenly became orthopneic and sought the help of a physician.

Physical examination that evening revealed complete collapse of the right lung. He was immediately roentgenographed and the clinical impression confirmed. Roentgenograms of the chest taken February 18, 1946, four months after his original accident, revealed complete collapse of the right lung with marked deviation of the mediastinal structures to the right side.

On admission to the Hospital of the University of Pennsylvania the physical examination was negative except for the findings in his chest. The trachea was displaced markedly toward the right. The left chest was hyperresonant whereas the right was dull, particularly at its base. Whistling breath sounds were heard over the right lung. The apex of the heart seemed close to the midline.

The patient's blood studies and urine analysis were normal. The red blood cell count was 4,000,000, the hemoglobin 85 per cent. The white blood cell count varied between 4,800 and 9,100, with 60 per cent neutrophils, 2 per cent

* From the Departments of Radiology, Surgery, and Bronchology of the Hospital of the University of Pennsylvania, Philadelphia, Pennsylvania.

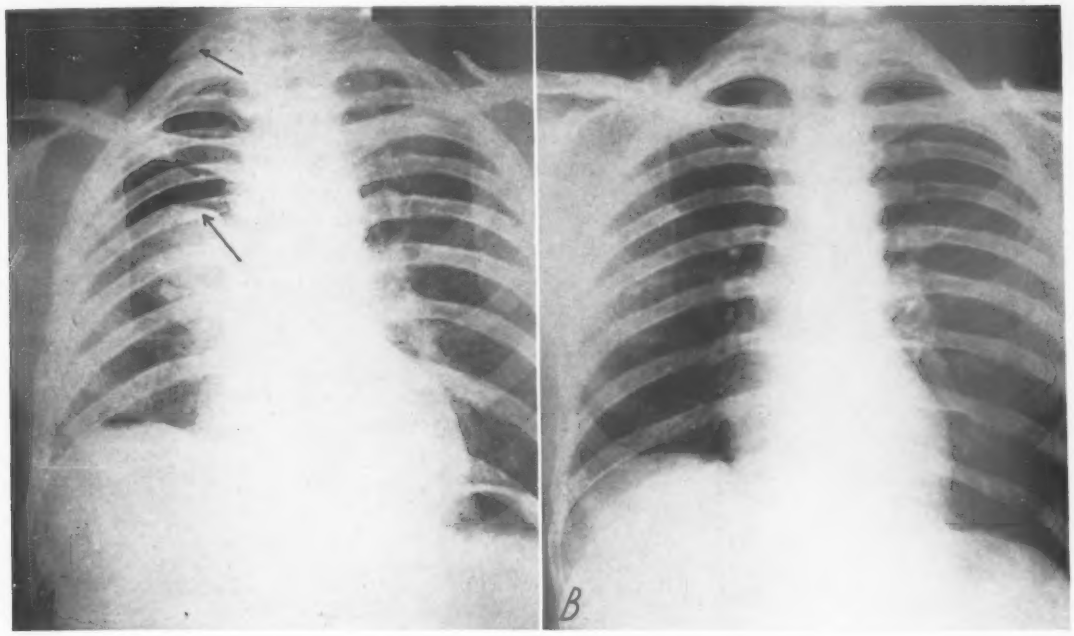

FIG. 1. *A*, roentgenogram obtained October 15, 1945, ten days after injury. The right lung is partially collapsed. Note the fractured first rib and elevated right hemidiaphragm. *B*, roentgenogram obtained October 27, 1945. The right lung has re-expanded completely. (Roentgenograms courtesy of Dr. John Harris.)

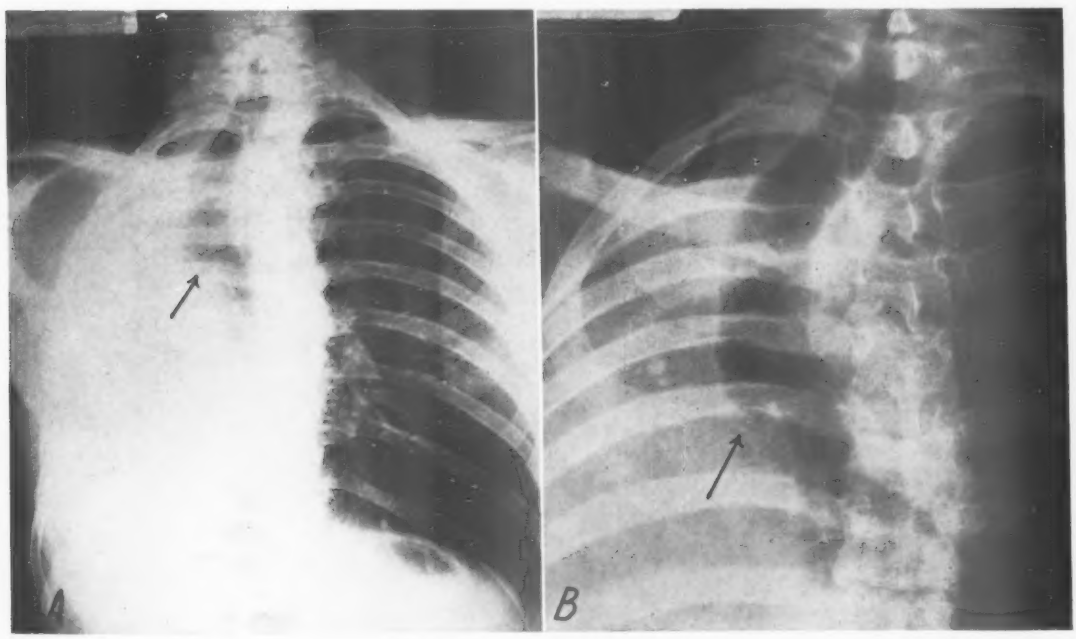

FIG. 2. (Same patient as Fig. 1) *A*, roentgenogram obtained February 22, 1946, after onset of severe dyspnea. The right lung is completely collapsed. *B*, this is a portion of the Potter-Bucky roentgenogram of the chest taken the same day. The deviated trachea is clearly defined. The obstructed right stem bronchus is seen at the arrow.

eosinophils, 4 per cent monocytes and 34 per cent lymphocytes. The blood Kolmer and Kline reactions were negative. The electrocardiogram was normal.

The patient's chest was first examined roentgenographically in the Hospital of the University of Pennsylvania on February 22, 1946, when the following was recorded (Fig. 2): "The soft tissues of the thoracic cage reveal no

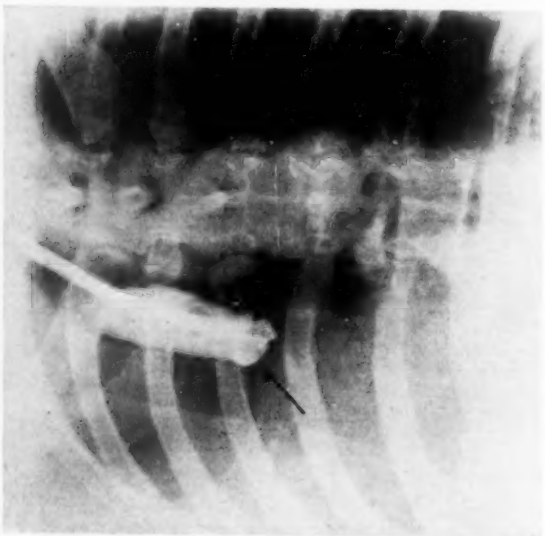

Fig. 3. (Same patient as in Figs. 1 and 2) Postero-anterior spot roentgenogram of the chest made with the patient lying in the right lateral decubitus position on March 6, 1946. The tip of the catheter lies in the blind pouch of the obstructed right bronchus. The bronchial obstruction is outlined by lipiodol, some of which is in the trachea.

abnormalities. There is an old fracture of the first rib on the right which is well united in adequate position. The configuration and alignment of the ribs are symmetrical. The trachea is displaced markedly to the right side. The heart and aorta lie almost entirely in the right hemithorax. The left hemidiaphragm seems depressed, the right cannot be delineated. The entire right lung is completely collapsed and the right half of the thoracic cage dense. The right main stem bronchus is occluded just beyond the carina. The latter is displaced toward the right and slightly upward. Distributed throughout the collapsed right lung are multiple calcified densities which may be the remnants of old calcified tuberculous foci. The left lung is emphysematous and clear."

The first bronchoscopy was performed on February 22, 1946, also, when the following was noted: "Bronchoscopic examination discloses the right main bronchus to be occluded by what appears to be a hard tumor mass. There is no definite fungating tissue and only a very superficial piece could be removed for biopsy. Careful search was made for a lumen into the remainder of the right side of the tracheobronchial tree, but none could be found. There is no evidence of suppuration. The bronchus on the left side is thick but not deformed. Secretion was submitted for bacteriologic examination."

On March 6, 1946, after a second bronchoscopy, which confirmed the original findings, a catheter was introduced through the larynx and trachea into the blind end of the right main stem bronchus. Then, under roentgenoscopic control, with the patient lying in the right lateral decubitus position, lipiodol was injected into the right side. Roentgenoscopically, the bronchial occlusion seemed complete. Recording spot roentgenograms were made with the patient lying first on his right side and then in every other position. These were reported as follows: "The films confirm the presence of a complete block of the main stem bronchus on the right side. We are impressed by the fact that the obstruction seems smooth in contour rather than irregular as one would expect in a lesion within the bronchus producing occlusion (Fig. 3). We believe that we may be dealing with a stenosing process around the bronchus which cuts it off."

On March 8, 1946, a third bronchoscopy was done and the following recorded: "Bronchoscopic examination reveals no change in the findings as previously noted. It would appear that about 1 cm. of the right upper lobe bronchus remains and ends abruptly at that point. Further small piece of tissue was removed for examination."

Smears and cultures taken directly from the occluded bronchus bronchoscopically revealed rare alpha prime streptococci, viridans and non-non-hemolytic streptococci, and *Staphylococcus albus*.

Histopathologic study of the biopsy sections taken from the base of the blind pouch were reported by Dr. Robert Horn to "consist of cartilage surrounded by areas of fibrous tissue containing mucous glands. The glands are lined by a single layer of cells, their nuclei being close to the periphery of the gland. The cartilage appears normal. Conclusion: Bronchus."

The patient was operated upon March 15,

1946, under endotracheal anesthesia. At operation the right lung was found completely collapsed. No tumor mass could be palpated. The great vessels of the right hilum were isolated and ligated and a pneumonectomy performed.

After the right lung was removed, the remaining portion of the right bronchus was identified and sectioned. One inch proximal to the point at which the bronchus had been amputated "a thin smooth red membrane lay stretched across the lumen of the bronchus that looked like normal bronchial mucosa with some element of scar tissue. The obstructing membrane had none of the characteristics of tumor. So complete was the obstruction that it was not necessary to close the bronchus itself."

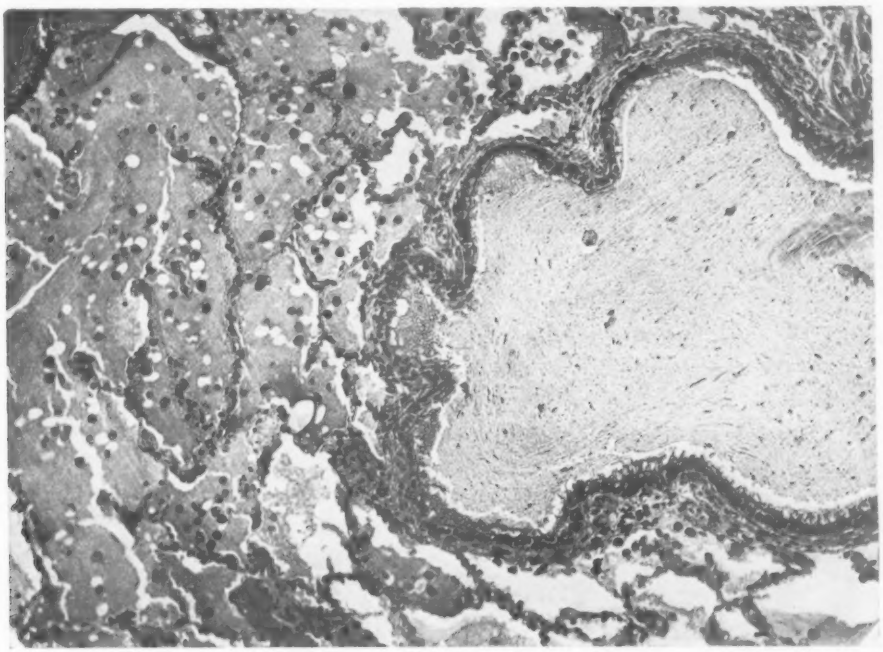

Fig. 4. Photomicrograph of a portion of the right lung removed at operation. The bronchiole is partially collapsed. Many alveoli are also collapsed. Note secretion and cellular debris in the bronchus and alveoli.

The pathologist's description of the resected right lung follows:

"*Gross Description:* The specimen is a right lung the over-all dimensions of which are 20 by 14 by 3.5 cm. The surface is dark reddish-blue. Crepitus is not demonstrated and the tissue does not float on water. Edematous fluid cannot be expressed from the tissue. A calcified nodule is present on the base of the upper lobe measuring 2.0 cm. in greatest diameter. Another somewhat smaller calcified node is found in the hilar region. Although the bronchi are filled with a clear viscid substance, no extrinsic or intrinsic obstructive lesion is demonstrated and the bronchi appear grossly normal. A few, dark, almost black, soft nodules are present on the pleural surface measuring 1.5 cm. in greatest diameter. On frozen section they appear to be anthracotic nodules. No other local lesion can be demonstrated in the parenchyma. A segment of main stem bronchus is submitted separately. The bronchus is 1.5 cm. in diameter and the segment is 2 cm. long. The wall is thickened and mucosal folds are present which appear to radiate toward one area. A rib is also submitted which appears normal. No sections are taken from the rib.

"*Microscopic:* (Fig. 4) The sections of bronchus reveal normal bronchial constituents. The mucosa is composed of well preserved dilated columnar epithelial cells. Smooth muscle and cartilage are present and appear essentially normal.

"The lung itself is atelectatic with partial collapse of most alveoli. Many phagocytes distended with a yellowish-brown pigment are present. The interstitial areas are sites of mononuclear inflammatory cell collections, while in

small areas, polymorphonuclear leukocytes are seen.

"Many erythrocytes and much edematous fluid are seen within the alveoli. The dark lesion described grossly is a small lymphoid nodule with much anthracotic pigment seen in the phagocytes of the reticular elements. Mucin is present in many of the smaller bronchi and bronchioles. There is no evidence of malignancy.

"*Diagnosis:* Atelectasis of right lung; cicatrix of right main stem bronchus (with occlusion). (Signed) Dr. Robert C. Horn."

When last examined in June, 1946, the patient was asymptomatic.

REVIEW OF LITERATURE

One of the first patients reported in the English literature with a torn bronchus was recorded by Sheild[16] in 1889.* His patient was caught between a van pole and a wall. Several ribs were broken and forced into the anterior mediastinum tearing the left main bronchus near the carina. The patient died soon thereafter.

In 1906 Barford[1] reported a four year old boy who died of a torn bronchus forty-five minutes after being run over by a van. Autopsy revealed several broken ribs and a torn left stem bronchus just distal to the carina.

King,[5] in 1907, reporting on "Medical and Surgical Practice in the Hospitals and Asylums of the British Empire" described the events leading to death in a four year old child who also had a torn bronchus. His description was so graphic, it seemed well worth recalling at the present time.

> An hour before admission the child had been knocked down by a brougham, rubber tyred. Whilst on the way to the hospital she had coughed up blood several times. On admission, the child was very collapsed, the temperature being subnormal, and the pulse running; there was no cyanosis and the respiration rate was 28 per minute.
>
> The fifth to eighth ribs were found to be fractured on the left side, the ribs on the right side being intact. It was noted that the movement on the right side of the chest was very deficient, respiration being mainly carried on by the left (the injured side). As any attempt at moving caused haemoptysis, the back of the lungs could not be examined; blood was brought up four times on the day of admission.
>
> The third day after admission, the child seemed much worse. The pulse and temperature were rising and cyanosis was present; the physical signs remained the same. The right pleural cavity was considered to be distended with air under a positive pressure. With a view of relieving this, the right side of the chest was punctured below the angle of the scapula with a fine trocar and cannula, the cannula being connected with a rubber tube, the distal end of which was kept under sterilized water. When turned on to the left side preparatory to making the puncture, the child coughed up a large quantity of red blood, none having been ejected during the previous twenty-four hours. The result of the puncture was an escape of air which bubbled up through the water; for the first few seconds the escape was continuous during both expiration and inspiration, but after a few seconds the air escaped during expiration only. During inspiration, there was no negative pressure, as evidenced by the fact that water did not tend to be sucked up the tube. After a few minutes, the cannula was removed, and the puncture sealed with gauze and collodion. During the day the child rapidly became worse and died at 10 P.M., fifty-five hours after the accident.
>
> On opening the thorax the right pleural cavity presented the appearance of a large open space, the lung being completely collapsed. The pleural cavity contained about 2 oz. of blood. There was no laceration of the parietal or visceral pleurae except for a small rent over the root of the lung. On the left side the pleurae were intact.
>
> The right lung was completely collapsed and airless, all portions sinking in water. There was a complete transverse rupture of the right main bronchus ½ in. from the bifurcation of the trachea. The pulmonary artery and vein were intact. The left lung was normal.

The same year, 1907, Moty and Guibal[11] published one of the earliest bilateral bronchial tears recorded in the literature. Their patient, a French cavalryman, was jolted from his horse-drawn cannon and run over by one of its wheels while on maneuvers at Verdun. His chest was crushed and he died in about ten minutes. Autopsy revealed tears in both main stem bronchi close to the trachea.

In 1907, May and Bowen[9] also reported a patient with a ruptured bronchus who died in twenty-six hours. Their patient's head was run over by a wagon which caused bilateral skull fractures. Whereas this patient's right stem bronchus was found severed just below the carina at autopsy, there was no evidence of damage to the bones of the thoracic cage, pleura or hilar vessels.

Several years later, 1912, Leckie[8] reported one of the first motor car accidents to produce a

* Sheild referred in this brief discussion to similar bronchial tears reported by others previously.

torn bronchus. His patient lived eight hours after his chest injury.

The first complete review of the subject also appeared in 1912, published by Schonberg.[15] He reviewed the patients reported by King,[5] Moty and Guibal,[11] and Leckie,[8] added to these 10 others he found in the literature, and described 3 additional new cases of his own.

Patrick[13] recorded a soldier in 1917 who died in seventy-two hours of a torn left stem bronchus. At autopsy fractured ribs, a broken sternum, and acute pericarditis were found in addition to the injured bronchus.

Lilienthal's book on "Thoracic Surgery," published in 1925, contains a personal communication from Major W. C. Thomas,[17] United States Army, describing a bronchial tear in a soldier who was crushed beneath an overturned coal wagon. He died suddenly nine and one-half hours after being hurt.

Probably the first patient known to have recovered from such an injury was reported in 1928 by Krinitzki.[7] The diagnosis was made at autopsy twenty-one years following the accident. The right main stem bronchus terminated in a blind pouch 3 cm. from the tracheal bifurcation.

Meade and Graham[10] published another fatal case in 1930. Their patient fell from the fender of a truck and was pinned between the vehicle and the road bank. He died in sixteen hours of a transverse rupture of the right main bronchus 5 cm. below the carina.

In 1936, Nicod and Urech[12] described their findings in a cavalry officer who fell from his horse and was crushed. This patient recovered and remained well for ten years when he died suddenly of a hemorrhage from esophageal varices complicating hepatic cirrhosis. His left bronchus was torn and sealed near the carina at autopsy.

Rienhoff,[14] discussing in 1936 the readjustments that occur in the chest following pneumonectomy, made reference to 2 patients upon whom he had operated and found post-traumatic "pulmonary atrophy." The first patient was injured at nine years of age and was operated upon twenty years later. The second was hurt at the age of three and was operated upon thirty-two years later.

In 1939, Jones and Vinson[4] followed a patient with a ruptured bronchus almost from the moment she was injured until she left the hospital with a completely collapsed left lung fourteen days later.

On admission to the hospital, physical examination of Jones and Vinson's patient revealed bilateral limitation of respiration, a tympanitic percussion note over both sides of the chest, and marked mediastinal shift to the left. Interstitial emphysema developed within five minutes and spread rapidly from the head and face to the abdomen, shoulders and arms. The dyspnea was intolerable. The systolic blood pressure dropped to 60, the pulse became thready and over 180 a minute, marked cyanosis developed and the patient lapsed into unconsciousness.

A short incision was made in the suprasternal notch and the dissection carried into the superior mediastinum behind the manubrium releasing large quantities of air. About 700 cc. of air was then withdrawn from the left hemithorax through a small needle cannula inserted between the ribs by reversing the flow of air in a pneumothorax apparatus. The same procedure was employed on the right side with the aspiration of 7,000 cc. of air. The initial pressure in the left hemithorax was plus 2 cm. of water; the final pressure minus 4 cm. of water. On the right side of the initial pressure was plus 4 cm. of water; the final pressure minus 3 cm. of water.

Following these procedures, plus artificial respiration, the patient began to breathe more easily, lost her cyanosis, and regained consciousness. The pulse rate dropped to 130, the systolic blood pressure rose to 105.

Within thirty minutes, the patient again lapsed into unconsciousness with dyspnea and cyanosis. This time a silver cannula was placed between the ribs into the right pleural cavity which released several liters of air under pressure. The cannula was strapped in place and covered with rubber dam which allowed air to leave the chest without sucking air back into the thoracic cavity. More air was then aspirated from the left thorax.

The patient's condition gradually improved until the morning of the third day of her illness when the mediastinum suddenly shifted to the left with marked respiratory embarrassment. Complete atelectasis of the left lung seemed present.

The patient left the hospital on the fourteenth day apparently well. Her left lung was completely collapsed, the right was healthy. She was bronchoscoped at this time and a longitudinal area of necrosis was found on the posterior wall of the left main bronchus begin-

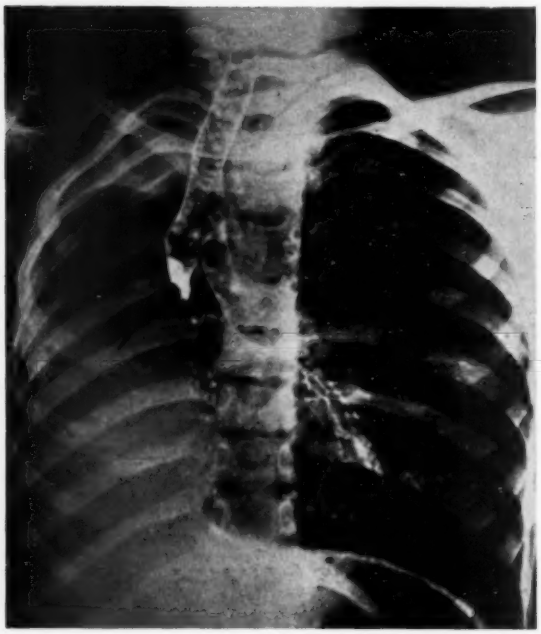

Fig. 5. Taken from Dr. Louis H. Clerf's original manuscript[3] with his permission reveals traumatic bronchial occlusion in a nine year old boy five years after a severe crushing injury to the right chest.

Fig. 6. Taken from Dr. Louis H. Clerf's original manuscript[3] with his permission reveals occluded left stem bronchus in a man, aged thirty-one, who complained of dyspnea and oppression in the left hemithorax. He had been in an automobile accident four months previously.

ning at the carina extending 3.6 cm. to a healing bronchial stricture measuring 2 mm. in diameter.

Clerf,[3] in 1940, called attention to 2 patients (Fig. 5 and 6) with bronchial atresia and atelectasis following chest injury, one of whom he saw four months after an automobile accident and the second five years after the accident. The former, a male, aged thirty-one, appeared

Fig. 7. Illustration from Tyson and Lyle[18] reproduced with their permission. The blind pouch in this obstructed left stem bronchus is filled with lipiodol. This roentgenogram was obtained four months after an automobile accident.

in excellent condition except for dyspnea on exertion. His left main bronchus terminated in a blind pouch 4 cm. beyond the carina. At bronchoscopy, the mucosa appeared slightly pitted, but no bronchial orifice or other communication could be observed. The second patient, a boy aged nine years, had no complaints. He was admitted for study, prior to tonsillectomy, to determine whether a general anesthetic could be safely administered. When last examined, thirteen years after his accident, he appeared perfectly normal.

One of the more recent reports dealing with this subject was published in 1942 by Tyson and Lyle.[18] Their patient (Fig. 7), a male, aged twenty-six, was admitted to the Mary Hitchcock Memorial Hospital four months after a serious automobile accident. His chief complaints included loss of weight, pain in the

chest, and dyspnea. Bronchography revealed complete occlusion of the left bronchus 3 cm. distal to the carina. Bronchoscopy revealed a blind pouch lined by normal bronchial mucosa.

When first seen by Tyson and Lyle the patient's vital capacity was 54 per cent of normal. After the diagnosis was established the patient was allowed to go untreated for seven weeks at which time he still complained of pain in the left chest, dyspnea, and had a vital capacity of 47 per cent.

Pneumothorax therapy was then begun in an attempt to correct the mediastinal shift. The initial inspiratory pressure was 38 cm. of water. The patient was considerably relieved by his pneumothorax which then had to be abandoned because he developed a hydrothorax.

Approximately two months later, the patient was again admitted with dyspnea and chest pain. Roentgen examination of the chest revealed no residual air or fluid in the left hemithorax. The initial inspiratory and expiratory pressures were minus 58 and minus 44 cm. of water respectively. Therapeutic pneumothorax was again instituted with considerable relief. After several fillings the patient was much improved and the air injections were discontinued.

When last examined, about fourteen months after his injury, the patient was comfortable. His pressure reading in the left pleural cavity was minus 8 cm. of water; in the healthy right chest, minus 6 cm. of water.

The most recent report on this subject was published in October, 1947, by Kinsella and Johnsrud,[6] who added 2 more records to the literature.

Their first patient was injured by the wheel of a farm truck; complaining of dyspnea, cough and expectoration, he was first seen by the authors twenty-eight months after his injury. Roentgenograms of his chest revealed complete occlusion of the right stem bronchus. A total pneumonectomy was performed which revealed not only the occluded main stem bronchus but an old rupture of the right upper lobe bronchus which was also healed and obstructed.

Their second patient, a boy, aged seven, was crushed between a truck and a brick wall. He was hospitalized immediately, at which time cyanosis, dyspnea, and marked interstitial emphysema were observed. He was examined bronchoscopically the second day, when a tear about 5 or 10 mm. long was identified in the right main bronchus near the carina. Two weeks later the boy was again examined by the bronchologist, who found no evidence of stenosis but did remove a large clot from the affected stem bronchus. The child left the hospital apparently well.

Twenty-four days after the original injury and eight days after his last bronchoscopy, the child was readmitted because of a severe cough and cyanosis. Roentgenograms of his chest revealed marked collapse of the right lung. When examined bronchoscopically, his right stem bronchus was almost completely closed.

The boy adapted himself very well to his bronchial occlusion and suffered no apparent real physical handicap.

DISCUSSION

At least 32 patients with bronchial tears have been recorded in the literature since 1889. Of these, 10 survived the immediate affects of their injury and developed bronchial occlusion. Seventeen had tears in the left main bronchus, 13 had tears in the right, and in 2, both bronchi were torn. In every instance, the bronchial defect lay immediately adjacent to or within a few centimeters of the bifurcation of the trachea.

With but 2 exceptions[13,17] the injuries were due to violent impacts with vehicles. Whereas fractured ribs were the rule, there were some individuals whose ribs were intact. Indeed, a few, including the patients recorded by May and Bowen[9] and Bradford,[2] suffered no thoracic cage damage. The torn bronchus almost always lay in the injured half of the thoracic cage to which the major force of the blow was delivered at the time of the accident.

Schonberg[15] attributed the bronchial tears to two factors. He felt that most tears were due to compression of the bronchus between the elastic chest wall and the rigid spine. He also believed that there existed abnormally high air pressures within the bronchus at the time of the impact which caused it to rupture.

Bronchial compression alone would not explain the rupture because there were many patients without severely damaged chest walls. The increased air pressure in the tracheobronchial tree seemed the more plausible explanation.

Usually, when a victim tries to protect himself from an onrushing blow, he "tightens up" and becomes rigid. This strain makes him stop breathing and hold his breath, inadvertently closing off his larynx and trachea. In this manner, the normally open tracheobronchial tree is converted into a closed air-filled system.

When the air pressure in such a closed system is raised gradually by an external force, the increased air tension that results is distributed equally throughout. When the external force is applied suddenly, however, the increased air pressure is greatest near the point of impact. When one remembers that the torn bronchus almost always lay in the injured half of the thoracic cage, it seems reasonable to attribute the tear to the latter mechanism. This would also explain the explosive onset of interstitial emphysema described in a few patients for the air causing the bronchial "blow out" would of necessity enter the interstitial tissues.

Finally, attention is called to the fact that in one individual[16] the torn bronchus was proved to be due to a fractured rib which pierced it.

The most common clinical finding was dyspnea. It was usually severe and disabling, but a few patients were not too distressed. Cyanosis occurred regularly, particularly in the severely dyspneic. A superficial cough was described in some which was often blood tinged or attended by frank hemoptysis.

About two-thirds of the victims revealed interstitial emphysema. Sometimes, it progressed rapidly over the face, abdomen, and arms assuming grotesque proportions. Its sudden appearance immediately after injury[4,10] suggested that the air was squeezed out of the lung, through the "blown out" bronchus into the soft tissues.

The classical signs and symptoms of shock were found regularly. In rare instances hemorrhage complicated the picture.

The physical examination varied remarkably depending upon the severity of the torn bronchus and the amount of air entering the thoracic cavity and interstitial tissues. Limited thoracic expansion (unilateral or bilateral), rapid shallow respiration, mediastinal shift, positive pressure pneumothorax, subcutaneous crepitation and fractured ribs were common. Anoxia and shock were the immediate threats to life. In some patients collapse occurred precipitously because of which constant vigilance was mandatory. In a few patients heroic methods had to be used to release collections of air that caused sudden shifts in the mediastinum.

The patients who died usually succumbed within the first twenty-four hours. A few lasted longer, one individual dying at the end of fifty-five hours.[5]

It is obvious that there must be some individuals with torn bronchi who have made complete recoveries from their injury. They would never have been recorded in the literature. Those who recovered from the immediate effects of their injuries and were reported in the literature all developed bronchial occlusion with complete pulmonary collapse. In some, it was recognized within days or weeks, in others months, and in a few it remained unrecognized for twenty to thirty years.[14]

The subjective symptoms in the patients who lived and developed post-traumatic bronchial occlusion varied. In rare instances there were absolutely no complaints, the findings being accidental[3,7,14] More commonly these individuals complained of vague substernal oppression. In some, it was actually painful. Dyspnea, mild or severe, was the rule in many.

It was noteworthy how often therapeutic pneumothorax relieved the symptoms. This was particularly noticeable in patients with abnormally high negative intrathoracic pressures in the affected hemithorax.[18]

Four patients had their collapsed lungs removed. Rienhoff[14] reported two, Kinsella and Johnsrud[6] one, and our patient was the fourth. All were much improved by their pneumonectomy.

The roentgen manifestations of bronchial tears varied depending upon when the patient was first examined. The chest ex-

amined soon after injury, while the rupture was still open, usually revealed interstitial emphysema, pneumothorax, pulmonary collapse, mediastinal shifts and fractured ribs. The interstitial emphysema commonly started in the mediastinum and then spread along facial planes to the homolateral supraclavicular fossa, neck, and chest wall. Sometimes it started on the chest wall at the same time, particularly when the pleural cavity was pierced by fractured ribs.

Pneumothorax was unilateral or bilateral. Whereas it was most common on the side of the bronchial tear, the rare patient presented more air in the contralateral hemithorax.

The position of the mediastinal structures also varied remarkably. As a rule, the mediastinum shifted away from the side of the greatest increased intrapleural pressure. As the air tension changed, its position changed. Occasionally the shift occurred suddenly and caused death. When positive pressure collections of air were absorbed or released, the mediastinum shifted back to its more normal midline position. Finally, when the lung collapsed, the mediastinum shifted toward the affected hemithorax.

Roentgenographically, traumatic bronchial occlusion was characterized by complete collapse of the homolateral lung and marked changes in the alignment of the mediastinum. Compensatory variations in the bones of the thoracic cage, as well as alterations in diaphragmatic levels were the rule. In rare instances, particularly when the bronchial tear and occlusion occurred early in childhood, the compensatory emphysema that developed in the normal lung was marked enough to herniate through the mediastinum into the side of the occluded bronchus, thereby revealing roentgen evidence of aerated lung tissue in the injured half of the thoracic cage.[14] When this developed, the collapsed atrophic lung occupied but a small portion of the homolateral hemithorax.

Bronchography always revealed complete bronchial occlusion. The lipiodol always entered a blind pouch close to the carina which was smooth in outline and cup shaped. Filling defects lining the bronchial walls were not seen in any of the patients recorded in the literature or in ours. Body section roentgenograms of the affected bronchus, although less brilliant than the lipiodol or pantopaque studies, were equally characteristic and diagnostic. They too revealed a blind pouch and perfectly smooth bronchial walls.

Of considerable interest was the fact that these collapsed lungs never became infected. Whereas pulmonary collapse is usually associated with pulmonary infection, there was not one patient in the literature in whom this was described either clinically or histopathologically. The fact that these were "complete" bronchial obstructions which prevented organisms and infected debris from entering the collapsed lung must have been the cause. A patient reported by Krinitzki[7] demonstrated this beautifully.

Krinitzki's patient died as the result of extensive pulmonary tuberculosis. At autopsy the entire right lung was riddled with tuberculosis, while the left lung, which was completely collapsed, was free of tuberculosis. Dissection of the latter revealed an occluded main bronchus. The patient's past history indicated that she had suffered a severe chest injury with a torn bronchus and bronchial occlusion seven years before she developed pulmonary tuberculosis. Thus, because her bronchus was entirely occluded, tubercle bacilli were denied entrance into the collapsed lung which remained uninvolved.

At autopsy, section of these atelectatic lungs often revealed the bronchial tree filled with jelly-like mucus.[14] This was found at operation and confirmed histopathologically in our patient (Fig. 4).

No one has treated enough patients with torn bronchi or traumatic bronchial occlusion to write authoritatively concerning treatment. The basic therapeutic principles involved, however, seem fairly well established.

When the patient has just been injured all efforts must be directed toward the

control of shock and hemorrhage. At the same time, one must maintain careful vigilance to prevent tension pneumothorax from developing if sudden deaths are to be avoided. The insertion of a catheter into the pleural cavity by an interrib trocar with constant suction of about 10 cm. of water may prove life saving, particularly when rapid reaccumulations of intrathoracic air cannot be controlled by repeated simple aspirations.

Once the acute phase of the injury has been survived, one is faced with the problem of preventing bronchial occlusion.

The histories of many patients with traumatic bronchial occlusion reveal that there usually exists a period of days or weeks between the date of the injury and the time when bronchial occlusion develops when the lumen of the torn bronchus must be open. Unless this were true, one could not explain the complete reexpansion of previously collapsed lungs observed roentgenographically. It seems reasonable, therefore, to postulate that had the bronchial tears been recognized early, the occlusions might have been prevented by successive bronchial dilatations and bronchoscopic aspirations. Whereas such instrumentation would not have been without hazard, so much would have been gained if successful that we plan to try it if afforded the opportunity in the future. Actually, if operated upon early, it would seem theoretically possible to close these bronchial tears surgically.

The therapeutic problems are different after the bronchi become occluded and the lungs atelectatic. In such instances cough, substernal oppression and dyspnea commonly develop due to mediastinal distortions and compensatory pulmonary emphysema.

Therapeutic pneumothorax has been helpful occasionally in these patients. This has been particularly true in patients with abnormally high negative intrapleural pressures. At least 4 patients[6,14] have undergone total pneumonectomy with marked improvement. Whereas thoracoplasty has not been employed, it may prove to be the treatment of choice when an unqualified diagnosis of traumatic bronchial occlusion can be established. Not only would it partially correct the deviated mediastinum and hyperventilated residual lung, but it would prevent blood from passing through the collapsed lung to the peripheral circulation as unoxygenated blood, thereby relieving dyspnea. Kinsella and Johnsrud[6] suggested that, among other modalities, oleothorax or cutting of the corresponding phrenic nerve might be worth considering.

CONCLUSIONS

1. Severe chest injuries may cause tears in the main stem bronchi at or close to the bifurcation of the trachea.

2. When this occurs, the patient usually reveals shock, dyspnea, anoxia, interstitial emphysema, and cough.

3. Whereas such accidents may cause death, patients have survived the immediate effects of their injury to develop post-traumatic bronchial occlusion with pulmonary collapse.

4. Routine roentgenograms of the chest immediately after injury may reveal fractured ribs, interstitial emphysema, pneumothorax, pulmonary compression, and mediastinal shift.

5. Later, when bronchial occlusion is complete, the classical roentgen manifestations of pulmonary collapse develop.

6. Bronchograms reveal a cup-shaped blind pouch at the site of the occlusion.

7. Substernal distress and dyspnea occur commonly in patients with post-traumatic bronchial occlusion.

We wish to thank Dr. Gabriel Tucker for allowing us to study and report this patient. We are also indebted to Dr. John Harris whose original roentgenograms were made available to us. Appreciation is also due Dr. Robert C. Horn whose pathological interpretations helped complete this report. Dr. Louis H. Clerf and Drs. M. D. Tyson and J. S. Lyle allowed us to use illustrations from their original manuscripts on this subject. We are indebted to them for this privilege.

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PULMONARY EMBOLISM WITHOUT INFARCTION*

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As a result of numerous well correlated clinico-pathological studies, pulmonary embolism is now known to be a common complication of many diseases and operations. Thus, Hampton and Castleman[4] reported pulmonary embolism or infarction in 9 per cent of 3,500 autopsies, while Möller[6] found pulmonary emboli in 28 per cent of 176 routine postmortem examinations. Carlotti and his associates[1] report an even greater incidence of pulmonary embolism in medical than in surgical patients, the average yearly percentage being 0.6 per cent. The increasing frequency of diagnosis is probably due to better diagnostic criteria and greater attention to this particular condition. Although emboli involving the larger pulmonary arteries usually produce characteristic symptoms and signs (chest pain, hemoptysis, cough, dyspnea, friction rub) emboli lodging in smaller pulmonary arteries may have few or no symptoms. It is not at all unusual to find emboli of the latter type at necropsy when they are entirely unsuspected clinically.

Pulmonary embolism, however, does not always result in the formation of a hemorrhagic infarct. Adequate clinical and experimental data support the thesis that embolism to a lung in an individual with a normal circulation does not ordinarily produce infarction. On the other hand, infarction is rather frequent in cardiac decompensation and particularly in severe mitral valvular disease. This apparent paradox is explained by the dual circulation to the lungs through the bronchial and pulmonary vessels. The former are concerned with the nutrition of the lungs while the latter are actively engaged in the respiratory exchange of gases. Guillot,[3] Miller,[5] and others, have clearly demonstrated communications between the bronchial artery and pulmonary veins. There are also abundant anastomoses between the bronchial and pulmonary capillaries. These collateral channels are so extensive that complete occlusion of one or even both pulmonary arteries may not result in infarction. It is significant that Carlotti and his associates,[1] in reporting on their large series of cases of pulmonary embolism, are careful to distinguish sharply between pulmonary embolism and pulmonary infarction, indicating their recognition that the two are not necessarily synonymous. In considering the roentgenologic findings in their cases, however, they deal entirely with pulmonary infarction and give no impression that there are any roentgenologic findings in pulmonary embolism without infarction. They do indicate that a small percentage of their cases of pulmonary embolism exhibited apparently normal lung fields in the roentgenogram.

That embolism or thrombosis of the major pulmonary arteries do not usually result in infarction is well known. In many cases death ensues so rapidly after embolism of the artery supplying a whole lung that there is no time for infarction to occur. There are other cases, however, in which occlusion of a major pulmonary artery has occurred with survival of the patient and with no evidences of infarction. Such a situation is illustrated by the following case recently observed:

A man, aged thirty-seven, with an Eisenmenger's complex was examined. Roentgenoscopic and roentgen kymographic studies demonstrated a marked enlargement of the major pulmonary arteries with a complete absence of pulsation in the right pulmonary artery. The shadow of the vessel was enlarged and much more sharply defined than normal. The radiability of the right lung field may well have been slightly increased above the normal although

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this was so minor as to be difficult to establish (Fig. 1). At autopsy, in addition to the congenital defects in the heart (Eisenmenger's complex), there was found a complete occlusion of the right pulmonary artery by an old organized thrombus. Marked atherosclerotic changes of all the pulmonary arteries were present. Nevertheless there was no evidence of infarction whatever in the lungs, the appearance corresponding well to the roentgenographic findings shown in Figure 1.

A somewhat similar case with almost complete thrombosis of both main pulmonary arteries, without infarction, is reported in the literature.[2]

Following prolonged roentgenologic studies, with postmortem controls, Westermark[7,8] concluded that hemorrhagic infarction does not occur unless there is an occlusion of both the bronchial and pulmonary arteries. If only the pulmonary artery is obstructed, infarction does not follow and the involved pulmonary segment remains viable even though it may be unable to carry on any exchange of gases. In the case of septic emboli, spread of the infection to the contiguous pulmonary vein and bronchial artery readily takes place and hemorrhagic infarction results. He found that only 20 per cent of the cases in which pulmonary embolism was established at autopsy showed evidences of infarction.

In spite of these investigations most roentgenologists still associate pulmonary embolism with an area of increased density in the roentgenogram. In 1938 Westermark[7] described the roentgen appearance of pulmonary embolism without infarction. In a review of the literature at that time he was able to find only one previous similar report by von Dehn. Because the importance of these observations has not been generally appreciated, as illustrated by the recent review of Carlotti and his associates[1] noted above, we wish to direct attention to Westermark's observations and to emphasize the frequency of pulmonary embolism without infarction. To do so, we are reviewing the roentgen signs and presenting 3 illustrative cases observed during the past year and confirmed at autopsy.

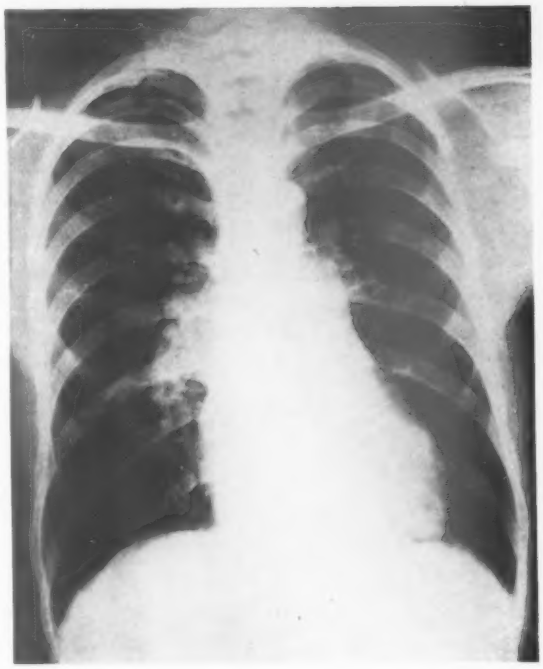

Fig. 1. Posteroanterior roentgenogram showing markedly enlarged, thrombosed right pulmonary artery in a patient with an Eisenmenger's complex. Note the normal appearance of the lung fields, the right being possibly slightly more radiable than the left. The absence of any evidence of infarction in a case with complete occlusion of the right pulmonary artery of long standing is illustrated here.

ROENTGEN FINDINGS

In pulmonary embolism without infarction the characteristic finding is ischemia of the involved pulmonary segment. This is represented by a segmental area of increased radiability on the chest roentgenogram. Central to the site of the embolism the vascular pattern is well outlined, while in the area itself the vascular pattern stops rather abruptly. In addition, there is often increased density and sharper demarcation of the involved vessel. The local area with diminished or absent vascularization corresponds to the pulmonary segment supplied by the embolic artery. As Hampton and Castleman[4] so ably demonstrated, the shape of an infarct is determined princi-

pally by the configuration of the involved pulmonary segment. This is likewise true of the area of ischemia due to embolism without infarction. Thus, in the case of an embolus to a pulmonary artery supplying a pulmonary segment, lobe or a whole lung, the segment, lobe or entire lung is anemic, as the case may be. The increased radiability is particularly striking when it occurs alongside an area of hemorrhagic infarction, since both processes may be found in the same lung or opposite lungs. These findings are in striking contradistinction to the usual area of increased density on the roentgenogram in cases of pulmonary embolus with infarction. The embolus without infarction may undergo organization and recanalization or it may be absorbed, thus leading to the reestablishment of the circulation in the affected pulmonary artery. If either of these two processes takes place, the area of increased radiability is replaced by a zone of normal density and vascularization. On the other hand, retrograde thrombosis may occur producing involvement of a larger area of pulmonary tissue.

The area of increased radiability due to pulmonary embolism without infarction must be differentiated from partial bronchostenosis with obstructive emphysema and also from localized areas of non-obstructive emphysema. In obstructive emphysema, the changes during expiration with the shift of the mediastinum toward the normal side and the depression of the involved diaphragm serve to differentiate these two conditions. Localized areas of non-obstructive emphysema may be somewhat more difficult to distinguish. However, the abrupt termination of the vascular pattern at the site of the embolus is usually sufficient to make the diagnosis.

CASE REPORTS

Case 1. A.K., a housewife, aged fifty-seven, was admitted to the University Hospital on April 26, 1947, complaining of abdominal discomfort of approximately ten years' duration. A cholecystectomy had been performed in 1938. In January, 1946, she became jaundiced and experienced several attacks of severe upper abdominal pain associated with nausea, vomiting and clay-colored stools. Four weeks prior to admission she was operated upon at another hospital at which time a T-tube was placed in the common duct without relieving the jaundice. On admission, the physical and laboratory findings were consistent with a diagnosis of obstructive jaundice.

On April 26, 1947, a chest roentgenogram showed normal lung fields with considerable elevation of the right diaphragm (Fig. 2). At 4:00 P.M. on April 19, 1944, the patient suddenly

Fig. 2. Case 1. Posteroanterior roentgenogram of the chest made on admission. The lung fields appear normal. The right diaphragm was slightly elevated.

became markedly dyspneic At 9:00 P.M. she experienced severe pain in the right chest. Physical examination revealed a temperature of 102°F., pulse rate of 125 per minute, and some moist rales at both bases. A medical consultant at this time suggested the diagnosis of congestive heart failure and recommended digitalization. The roentgenogram of the chest was repeated and showed marked elevation of the right diaphragm with a sharply defined area of increased radiability and ischemia in the right lower lobe (Fig. 3). A diagnosis of embolism without infarction was ventured by the roentgenologist.

On April 30, 1947, tenderness along both calf

veins and the left femoral vein was noted. The patient also had a mild episode of hemoptysis. Two electrocardiograms were negative. Penicillin and heparin were instituted and the patient was digitalized. On May 3, 1947, she began to bleed from the mouth and nose and the heparin dosage was reduced. She then seemed to improve slightly, even though the jaundice increased in severity. From May 17, 1947 on, her condition steadily deteriorated and she died on May 21, 1947.

The important findings at necropsy were confined to the pancreas, biliary tract, heart and lungs. A small calcified cyst was present in the

Fig. 3. Case 1. Anteroposterior roentgenogram made six and a half hours after the onset of symptoms of pulmonary embolism. A segmental area of increased radiability in the right lower lobe is shown. Note the relative absence of vascular pattern and the sharp termination of the pulmonary artery shadow. The changes are readily recognized in contrast with the findings seen in the film made before the onset of the embolus (Fig. 2).

body of the pancreas. The right and left hepatic ducts, as well as the distal end of the common duct, were obstructed by scar tissue. The mitral valve was thickened and had a few soft vegetations along its free border. The left pleural cavity was obliterated by adhesions, while the right contained 200 cc. of blood. An embolus was found in the pulmonary artery supplying the right lower lobe but no infarction was present (Fig. 4). Pulmonary edema of the left

Fig. 4. Case 1. Postmortem photograph of the right lung. The arrows point to the pulmonary artery of the right lower lobe which contained the embolus.

lung and the right upper and middle lobes was also noted.

Case 11. E.T., a white female aged seventy-one, was admitted to the University Hospital on December 2, 1946, with complaints of abdominal pain and vomiting of six weeks' duration. Prior to this time there had been episodes of nervousness, exertional dyspnea, headache and dizziness. There was a long history of right upper quadrant pain, nausea and vomiting. On admission, a vague, slightly tender midline epigastric mass was palpable.

On December 3, 1946, a gastrointestinal series revealed a considerable degree of pyloric obstruction. A barium enema on December 16, 1946, demonstrated abnormal separation between the greater curvature of the stomach and the transverse colon with a pronounced indentation of the superior surface of the transverse colon near the splenic flexure. The clinical impression was carcinoma of the head of the pancreas with secondary infiltration of the stomach and colon.

An exploratory laparotomy was performed on

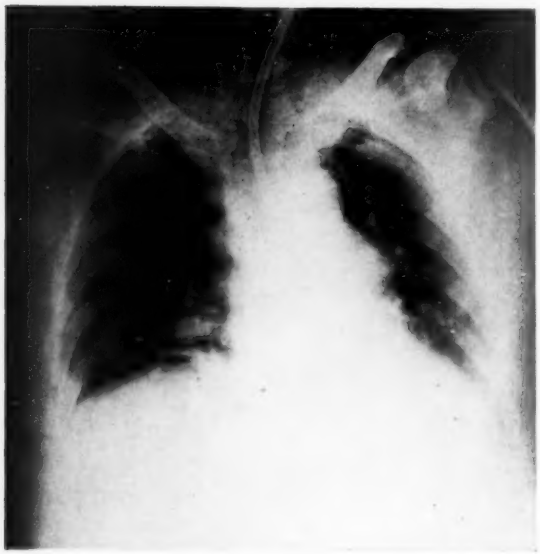

Fig. 5. Case 11. Anteroposterior view of the chest made on the day of operation demonstrating some congestion of the left lung field and a relatively normal right lung. The right diaphragm is slightly elevated. The air under the right diaphragm was due to the abdominal surgery.

December 19, 1946, and a carcinoma of the gallbladder was found with peritoneal carcinomatosis. A gastroenterostomy and catheter choledochostomy for drainage of the common duct were done. Postoperatively the patient's temperature rose to 103.6° F., with a pulse rate of 110/120 and respirations of 36. A chest roentgenogram at this time showed only some elevation of the right diaphragm with residual air under the diaphragm from the previous surgery (Fig. 5). On December 20, 1946, the patient complained of a slight cough and abdominal pain. The chest roentgenogram (Fig. 6) was repeated on December 21, 1946, demonstrating marked elevation of the right diaphragm. The heart was slightly displaced to the left and patchy areas of consolidation were present in the left lung. In the right lung there was abrupt termination of the vascular shadows to the lower lobe with increased radiability in this area. The possibility of an embolus without infarction was then suggested.

The patient received parenteral fluids, digitoxin, aminophyllin and mercupurin, but in spite of this therapy a persistent oliguria developed and she died on December 25, 1946.

At necropsy, a large bile stained abscess was present under the right diaphragm. There was obvious leakage around the catheter in the common duct with small collections of bile in the right quadrant and the right lateral gutter. The gallbladder was the seat of a carcinoma. It contained four stones and was bound down by many adhesions. The common duct was surrounded but not obstructed by the carcinomatous process which extended around the proximal duodenum. Although the liver appeared to be grossly normal, microscopic study showed some metastases. There was also diffuse peritoneal carcinomatosis.

The heart was slightly enlarged. There was some left ventricular hypertrophy, calcification of the aortic leaflets and atherosclerosis of the aorta.

The right pleural cavity contained 150 cc. of cloudy sanguineous fluid while the left pleural cavity was partially obliterated by adhesions. There was atelectasis of much of the right middle lobe and right lower lobe with petechial hemorrhages on the surface of these lobes. Near the hilum of the right lung at the bifurcation of the pulmonary arterial branches to the

Fig. 6. Case 11. Anteroposterior view of the chest made thirty-six hours later, after the development of pulmonary symptoms. Note the marked elevation of the right diaphragm. There is considerable radiolucency and ischemia of the right lower lobe. Note also the densities in the left lower lobe which were due to congestion and bronchopneumonia. A pulmonary embolus without infarction on the right side was found at autopsy.

middle and lower lobes, there was a rider embolus without infarction. The left lung was somewhat congested and the bronchi exuded a cloudy, somewhat purulent fluid on compression.

Case III. The third patient seen, after operation, had a few symptoms to suggest pulmonary embolism. On roentgen examination there were evidences of increased radiability in the right lower lobe especially as compared to the remaining lung fields. On the left side there were two small areas of increased density in the lower lobe. The diagnosis of pulmonary embolism without infarction on the right side and possible pulmonary emboli with infarction on the left was made antemortem. These findings were confirmed at autopsy, an embolus to the pulmonary artery supplying the right lower lobe being present without any lung infarction. There were two emboli in the left lower lobe with hemorrhagic infarcts in the appropriate segments. Owing to the fact that the films were made at the bedside under unfavorable conditions they are not suitable for reproduction.

DISCUSSION

In all 3 cases there were symptoms suggestive of embolism but the physical signs were not evident. While the roentgen findings are not unusually striking the changes in the appearance of the lung from that found on roentgenograms made before the onset of the acute process were sufficient to give credence to the observation of increased radiability and abrupt termination of the vascular pattern. The findings noted above were fully confirmed at autopsy. Other cases of similar character have been observed but are not reported since the patients survived and autopsy confirmation could, therefore, not be obtained.

SUMMARY

1. Pulmonary embolism may occur without infarction owing to the double circulation of the lungs.

2. In pulmonary embolism without infarction the characteristic roentgen findings are increased radiability and ischemia of the involved pulmonary segment. Abrupt termination of the embolic pulmonary artery is also frequently demonstrable. This contrasts strikingly with the usual area of increased density on the roentgenogram found in cases of embolism with infarction.

3. The differential diagnosis of embolism without infarction is discussed.

4. Three cases of pulmonary embolism without infarction, confirmed at autopsy, are presented.

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BENIGN PEDUNCULATED TUMORS OF THE ESOPHAGUS

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PEDUNCULATED tumors of the esophagus are of special roentgenological interest because they present definite shadows that may be overlooked or misinterpreted when the patient's history and physical examination do not suggest this type of lesion.

Fahr[4] reported a case which had both roentgenologic and esophagoscopic examinations yet the true diagnosis was not made until autopsy was done. Postmortem examinations have first revealed the tumor in many of the reported cases and in most instances of discovery at autopsy there was no history of symptoms referable to the esophagus. Davison's[2] case had no symptoms and he discovered the large pedunculated tumor when it extruded from the mouth with vomiting during a temporary gastrointestinal upset. Thus pedunculated tumors of the esophagus may be encountered in a routine examination of the gastrointestinal tract. Some of the mistaken diagnoses made from roentgenological examinations were substernal thyroid, cardiospasm with dilated esophagus, and extra-esophageal mediastinal tumor.

Long before the discovery and diagnostic use of the roentgen ray several textbooks of pathology stated that polypi of the esophagus may occur with long pedicles. Probably the first detailed case report of benign pedunculated esophageal tumor was made by Monro[9] in 1763. He gave a complete account of the history, physical findings, and treatment. Since 1763 several similar cases have been reported.

Vinson[16] reported the first case in the American literature. Recently Samson and Zelman[13] reviewed the literature to find 25 cases besides their own of pedunculated esophageal tumors having a length of 7 cm. or more. Tamiya and Nosaki[15] in 1926 claimed to be the first to make a correct diagnosis from the roentgenological findings. Patterson[12] credits Sommer[14] with being first to make the diagnosis by means of roentgen studies.

In the case to be reported an esophageal tumor was considered prior to roentgenological examination because the patient gave a history of having regurgitated a fleshy mass, then swallowing it when he found it to be firmly attached somewhere in his throat.

Three of the cases reported by Moersch and Harrington[8] had regurgitated their pedunculated tumors and in each case the patient had attempted to bite it off. In each of the 3 cases surgical removal was successful.

A more recent study of benign esophageal tumors of all types by Adams and Hoover[1] obtained reports on 147 cases. They added 3 case reports in 1 of which the patient could regurgitate the tumor.

We report our case as follows:

CASE REPORT

S.R., male, aged seventy, complained of nocturnal attacks of choking and suffocation. He also had a constant feeling of fullness in the neck and upper mediastinum. Symptoms were first noted twelve years ago and had gradually increased. Two years ago distress became so severe that he would be wakened frequently by choking and suffocation. Six months ago he raised a smooth tumor mass from the throat during a severe attack of choking. The mass protruded beyond the mouth and when it was in this position did not afford obstruction to breathing (Fig. 1). An unsuccessful attempt was made to bite off the tumor. Within a few seconds the mass was swallowed without difficulty. A few weeks later a similar episode occurred and the patient noted, by use of a mirror, that the tumor was a two-pronged, fleshy mass. He found that sleeping at about 40 degrees

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elevation of the head and shoulders would prevent the choking and suffocation. There was no remarkable swallowing difficulty at any time.

Physical Examination. General physical examination failed to reveal anatomical abnormality or evidence of disease. The patient was well nourished and appeared to be in good health. Examination of the nose and throat by direct and indirect methods was negative. During the examination of the throat the patient's gag reflex was activated and caused regurgitation of the tumor so that part of it could be examined.

Roentgen Examination. On March 11, 1942, the patient was referred by Dr. Wm. F. Molt for roentgen examination. The esophagus was examined, using barium mixture, and a large filling defect was found extending from the level of the seventh cervical vertebra down to the sixth dorsal vertebra (Fig. 2). The outline of the tumor shadow was smooth and there was no obstruction to the passage of barium. Irregularities at the upper limit of the shadow appeared to be due to the attachment of the pedicle though the exact anatomical location of attachment was not clear. The trachea was displaced anteriorly about ¾ inch from the level of the manubrium down to the carina and there was no evidence of lung, heart, or aortic disease.

Impression. Benign pedunculated esophageal tumor.

Operation. The tumor was removed by Dr. Wm. F. Molt on March 16, 1942. He gives the following description of the procedure: "Under general anesthesia a suspension apparatus with a specially constructed long spatula was used to expose the mouth of the esophagus. With the suspension apparatus adjusted and using head-projected illumination both hands of the operator were free. The cricoid cartilage was lifted with the rubber covered distal end of the spatula to expose the mouth of the esophagus. This method revealed the base of the mass which was just inside the esophageal orifice. By direct vision a special clamp was applied at the tumor attachment and the pedicle was ligated with No. 10 silk ligature. The pedicle was then severed above the clamp. The tumor measured 1 inch in diameter and 8½ inches in length."

Fig. 1. Showing the tumor as it protruded from the mouth without affording obstruction to breathing.

Fig. 2. *A*, site of pedicle attachment found at time of removal. *B*, level of attachment indicated from the preoperative roentgen study. *C*, translucent areas caused by the filling defect.

The patient made an uneventful recovery and left the hospital on the fourth day. There was no hemorrhage and all of his symptoms were relieved.

Note: The attachment of the pedicle was higher than anticipated from the roentgeno-

logical study. The slender pedicle extended from the level of the fourth cervical vertebra to the seventh which was the upper level of the observed filling defect.

Gross and Histopathological Examinations. The gross specimen consists of an elongated bifurcate tumor mass having an over-all length of 12.5 cm. The diameter of the main body is 4.5 cm. and the diameter of the bifurcations is approximately 2 cm. The mucous membrane surface is smooth except for small granulations on one of the secondary projections. The entire tumor is soft and elastic.

Section for microscopic study taken through various levels of the tumor mass removed from the esophagus show a fibrolipomatous structure which is covered by a dwarfed atrophic layer of squamous epithelium. Papillary pegs of squamous epithelium are absent and the basement membrane sharply delineated. The underlying tissue is composed of strands of dense fibrous connective tissue in various degrees of hyalin degeneration, permeating the structure in wild and irregular disorder. The stroma also shows patchy accumulations of fatty tissue surrounding or infiltrating the fibrous tissue. An occasional zone of myxomatous tissue can be identified. In all this arcuate pattern there is a massive edema. Small round cell infiltration is diffusely disseminated throughout the central core of connective tissue, and is present in a zone-like margin just beneath the squamous cell lining. In a few areas the epithelium becomes keratinized and piles itself into tiny microscopic projections which are all quite regular in cellular content without neoplastic deviation.

Impression. Polypus of the esophagus with low grade inflammatory process, benign.

Out-Patient Progress. Four years after removal of the tumor the patient was free of symptoms and in excellent general health.

GENERAL DISCUSSION

Pedunculated tumors arising at the upper end of the esophagus are nearly always single, whereas multiple pedunculated tumors may be found in the middle and distal thirds.

It is remarkable that a majority of the single pedunculated tumors arise in the region where esophageal diverticula commonly have their origin. The esophagus at this level is narrowed and the mucosa is redundant due to the high degree of mobility necessary for swallowing.

Once a benign tumor forms in the esophageal wall in this region or a fold of redundant mucosa sags sufficiently, the peristaltic action with traction of the passing food tends to gradually drag it downward.

The peristaltic traction may also produce the bifid structure at the distal end. Garretson and Hardie[6] believe peristaltic action caused the bifid distal end of the tumor found in their case.

Symptoms. The tumor may reach a very large size without causing esophageal obstruction. Pape and Spitznagel[11] reported a case of very large tumor without history of difficulty in swallowing. The chief complaint was dyspnea and substernal thyroid was thought to be present.

As the tumor elongates and approaches the cardia, obstruction develops.

Pain is not present unless there is ulceration of the tumor or the adjacent esophageal wall.

Fahr reported a case which was examined roentgenologically and findings compared with those at postmortem. The roentgenological findings in his case were esophageal dilatation and cardiospasm. Esophagoscopy did not visualize the tumor which was thought to be extrinsic to the esophagus. The patient died of starvation and Fahr stated that the patient could probably have been saved had the diagnosis been made.

Cardiospasm is not uncommonly associated with the very long tumors. Haenisch[7] reported a case which showed mediastinal widening, esophageal filling defect and cardiospasm. The diagnosis was cardiospasm.

Tracheal compression is present in most cases having large tumors. Dyspnea may be present without dysphagia. Pape and Spitznagel's case, previously referred to, had a very large globular tumor which was diagnosed as substernal thyroid and operated on. The tumor was not found and the patient died several weeks postoperatively.

Diagnosis. When mediastinal widening is seen in the chest roentgenogram and symptoms referable to the esophagus have been present over a long period of time, benign tumor should be considered. Since the smaller tumors may be silent, routine gastrointestinal examinations revealing slight abnormality in the passage of barium through the esophagus, such as splitting of the stream or uneven distribution, should lead to a detailed examination.

Due to the usual irregularity at the distal portion of the tumors and associated uneven pressure on the various areas of the tumor by the esophageal wall, the shadow produced by the mass will be remarkably uneven as outlined against the esophageal wall. The mottled appearance is partly due to pressure afforded by extra-esophageal mediastinal structures causing the barium stream to be thin, whereas it will be heavy over areas not adjacent to firm structures.

The area of attachment may be identified by remarkable irregularity in the esophageal wall just above the pedicle shadow. Esophageal peristalsis and elasticity are maintained around the filling defect.

Double contrast examination as described by Palugyay[10] may be helpful in establishing a diagnosis with difficult cases. This is simply done by having the patient take barium then swallow air.

Feldman[5] reported an adenocarcinomatous pedunculated polyp and states that the diagnosis of malignant degeneration in a polyp cannot be made.

DIFFERENTIAL DIAGNOSIS

The following conditions are to be considered: carcinoma, extra-esophageal tumors, mediastinal tumor, cardiospasm, aneurysm, varices, and substernal thyroid.

Carcinoma of the esophagus may in rare cases form protruding lesions similar to the granular mushrooming skin lesions. This type of malignancy may be differentiated by its shorter length, greater diameter, and rough surface.

Extra-esophageal tumors can be differentiated by demonstrating displacement of the esophagus or ruling out intrinsic growth when the mediastinum anterior to the esophagus holds the tumor.

Simple cardiospasm can be ruled out as a cause for slight esophageal dilatation by demonstrating the free passage of barium and the presence of a filling defect. When there is secondary cardiospasm caused by the tumor the demonstration of the filling defect is the only reliable means of roentgenological differentiation.

Tracheal stenosis should not afford difficulty in the differential diagnosis even in the cases giving a history of dysphagia.

Small polypi in the distal two-thirds of the esophagus may be mistaken for varices which, in general, produce smaller shadows. Either condition may cause severe hemorrhage, as in the case reported by Dickes, Knudsen and Franco.[3]

Histopathologically the tumors may be myoma, fibromyoma, polyp, or lipoma. Vinson, Moore and Bowing[17] reported a pedunculated hemangioma.

SUMMARY AND CONCLUSIONS

Pedunculated tumor of the esophagus is rare and may be encountered unexpectedly on routine examination since, in some cases, symptoms are mild or not elicited.

Tumors of this type arise in the uppermost portion of the esophagus due to redundancy and elasticity of the esophageal mucous membrane in this region which is greater there than in any other part.

Grossly these tumors are smooth, about one inch in diameter, variable in length and may have multiple projections distally.

Microscopically most pedunculated tumors arising from the hypopharynx are fibrolipomas.

A correct diagnosis is important because the tumors are amenable to surgical treatment in most cases.

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NONSPECIFIC ENTEROCOLITIS

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WE HAVE observed a number of cases of enteritis at postmortem which presented unusual features. One of these cases seems to be classified best as nonspecific enterocolitis but might be a variant of either granulomatous enteritis or ulcerative colitis. Other cases seem to be typical instances of chronic ulcerative colitis with exceptionally extensive involvement of the small intestine. Three cases, 2 of granulomatous ileocolitis and the other ulcerative colitis with small intestinal involvement, were complicated by amyloidosis. These cases are reported to illustrate the difficulty of making an unequivocal diagnosis in many instances of nonspecific inflammation of the small intestine. The case reports follow:

CASE 1. *Granulomatous Jejuno-ileitis with Amyloidosis, Confused with Ulcerative Colitis during Life.*

H.M. This woman was first admitted to The Mount Sinai Hospital in February, 1936, because of lower abdominal cramps for three months, blood-streaked stools for two months and diarrhea for three weeks. Physical examination revealed a pale, chronically ill-appearing girl. The heart was slightly enlarged to the left and there was a soft systolic murmur heard loudest in the pulmonic area. The abdomen was soft and not distended. There was slight left lower quadrant tenderness. The tip of the spleen was just palpable. An intertriginous erythematous eruption was present.

Laboratory Data. Hemoglobin 55 per cent. White blood cells 12,800 per cu. mm., with 64 per cent polymorphonuclear leukocytes. Stools were liquid and guaiac test 4 plus. Sigmoidoscopy revealed congested, edematous but smooth mucosa. Blood urea nitrogen 8 mg. per 100 cc. Total protein 8.7 grams. Dysentery agglutinations were negative.

Barium enema failed to show any definite evidence of ulcerative colitis aside from slight loss of haustration in the lower descendens with atony. The ileum was not filled.

Progress. She received carbarasone and emetine therapy, in addition to several blood transfusions. She was discharged much improved on the nineteenth day. Her stools were liquid but less frequent.

Approximately a year later she was readmitted. For the preceding four months abdominal cramps were more severe and bowel movements more frequent. There had been an 8 pound weight loss. In addition, she had noted tender reddened areas over both legs which made walking impossible.

Barium enema now suggested a rather severe inflammatory process involving the entire colon except for the sigmoid and rectum and sigmoidoscopy was negative. Her temperature was 100.4° F. on admission, but in the next four days began to show daily spikes to 103° F., coincident with the appearance of new lesions of erythema nodosum. She was given several transfusions and was discharged after three weeks with a diagnosis of chronic nonspecific ulcerative colitis.

She did well for about sixteen months but had to be readmitted because of severe right lower quadrant pain for five hours. Physical examination showed the abdomen to be soft but there was slight tenderness and rigidity in the right lower quadrant. White blood cells 17,000 per cu. mm., with 66 per cent polymorphonuclear leukocytes. An appendectomy was performed and the surgeon's note is as follows: "On entering the peritoneal cavity, a large mass was found in the region of the cecum, which itself appeared normal. The appendix was thickened and inflamed. The major portion of the mass consisted of terminal ileum which was markedly thickened and indurated for 6 inches, with further thickening of its mesentery for an additional 3 inches proximally. This segment was reddened and its surface was lusterless. It presented the appearance of a nonspecific regional ileitis. The lesions stopped sharply at the ileocecal valve."

The pathological report was chronic and acute appendicitis.

The postoperative course was uneventful and in view of the operative findings, it was felt

Fig. 1. Case 1. Colon examination after evacuation and introduction of air. Arrows indicate stenosed terminal ileum.

that she was probably suffering from regional ileitis, rather than colitis.

She did well after discharge and was married in 1939. Eight months later she again began to have abdominal cramps associated with five to eight movements per day. Each following winter for a period of a month or two she had exacerbations of her disease. In June, 1945, she first noticed bilateral ankle swelling which gradually spread upward to involve the thighs. Also, at this time, her face and eyelids became slightly swollen at night and two months before entering the hospital she noted that her abdomen was gradually becoming larger. Albuminuria was found a few months after the onset of the swelling and she was treated with lactoalbumin elsewhere for a week just before entering The Mount Sinai Hospital. Temperature on admission was 101.5° F. She appeared chronically ill; face and eyelids were pale and moderately edematous. There were signs of fluid at the right base, the heart was slightly enlarged and there was a systolic murmur audible all over the precordium. One observer felt an enlarged liver and spleen and elicited signs of fluid in the abdomen but others were unable to substantiate these findings. The sacrum and extremities were edematous.

Barium enema showed cecum and ascending colon filled with fecal material. Edges appeared to be somewhat serrated and the tip of the cecum was irregular. The terminal ileum was narrowed (Fig. 1). Barium meal examination showed a stenotic loop of bowel in the lower jejunum (Fig. 2). Adjacent to it there were several segments probably of proximal ileum which had lost their normal mucosal pattern. The changes suggested granulomatous jejunoileitis.

While she was in the hospital the profuse albuminuria continued unabated and the Esbach reaction reached 6 grams per liter. The urine also continued to show casts, red blood cells and white blood cells. The blood pressure was maintained at a level of approximately 120/70. Some observers entertained the diagnosis of amyloidosis while most favored the diagnosis of glomerulonephritis. The first Congo red determination was equivocal as some of the dye was excreted in the urine. A punch biopsy of the liver was negative for amyloid disease.

The fifth and last admission was two months later. She had done well until four days prior to

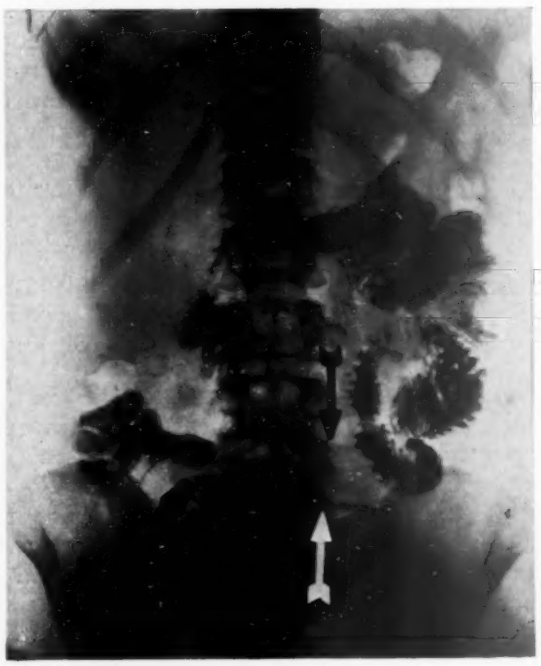

Fig. 2. Case 1. Barium meal. Arrows indicate stenosed ileal segment.

admission when she suddenly was seized with pain in the hypogastric region. Her stools were now diarrheic and foul-smelling. For the thirty-six hours preceding admission there had been neither bowel movement or flatus. There was persistent nausea and vomiting.

It was felt that a perforation of the small intestine had taken place. Another opinion was that she might have peritonitis secondary to renal disease. She developed severe oliguria with a rising blood urea nitrogen. An abdominal tap was performed and purulent fluid containing gram-positive diplococci (culture negative) was obtained. Roentgen examination of the abdomen was consistent with the diagnosis of a reflex ileus. Her condition was desperate and in spite of transfusion and penicillin therapy she showed no tendency to rally and died on the sixth day after entry.

Preliminary Anatomic Diagnosis. Regional enteritis involving jejunum and terminal ileum; acute fibrinopurulent pelvic peritonitis; amyloidosis of kidneys, spleen, adrenals, thyroid, heart; congestion and fatty infiltration of heart; papillary cystadenoma in a paraovarian cyst—left; decubitus ulcer.

This case is being reported in detail by Cohen and Fishman.

Comment. Postmortem examination in this case revealed typical chronic granulomatous jejuno-ileitis. There was no evidence to support the diagnosis made at one time during life of ulcerative colitis. Unfortunately the roentgenograms are not available for review but undoubtedly the interpretation was based upon minor deviations from the normal which were fitted to a tentative clinical diagnosis. The complicating amyloidosis will be discussed briefly in connection with Case III.

Case II. *Granulomatous Jejuno-ileitis with Amyloidosis.*

G.F., female, aged thirty-nine, was admitted six times to The Mount Sinai Hospital. First admission was in December, 1935, because of nine months of colicky, abdominal pain, which was most marked in the right lower quadrant and was associated with diarrhea and occasional bloody stools. There had been visible and palpable peristalsis noted the month before admission. A 57 pound weight loss occurred in the year preceding admission. Physical examination revealed an emaciated woman with a tender, orange-sized mass in the right lower quadrant. The stools were guaiac positive. Barium enema showed the ileocecal valve to be incompetent; the terminal ileum, which was filled for a distance of a foot, appeared to be constantly narrowed and irregular in outline. The changes suggested the possibility of granuloma of the small intestine. Barium meal examination also showed this stenotic lesion. At operation the cecum seemed to be free of disease. The distal ileum showed an extensive lesion reaching about 5 feet proximally from the ileocecal valve. The glands of the adjoining mesentery were markedly involved. An ileocolostomy was performed.

She was admitted five months later for the second time, and 2 feet of the distal ileum, cecum, and the lower part of the ascending colon were removed. The previously inflamed and thickened ileum now appeared as a small narrow tube without signs of inflammation and no glands were seen in the mesentery as on the first admission.

The patient did well for about a year but then was readmitted for the third time because of two months of diarrhea and cramp-like abdominal pain. Physical examination revealed only some tenderness in the right lower quadrant and periumbilical area. Barium meal suggested a recurrent ileitis indicated by marked irritability of the distal ileum which never filled well. Operation was considered inadvisable because of the extent of the disease process.

A month later, a right lower quadrant mass was found. At exploration a mass of agglutinated intestinal loops was found consisting of the distal portion of the ileum which was adherent to the bladder. Three feet of the terminal ileum were involved in an extensive inflammatory process and a secondary ileocolostomy with ileotransverse colostomy was carried out. Evidently in spite of an adequate resection at the first operation, the disease had recurred.

She was again admitted several months later because of weakness, anemia and weight loss. Roentgen examination showed a recurrence of the disease process. She was treated with transfusions and dietotherapy. Because there was improvement in her symptoms operation was deferred.

She was admitted for the sixth and last time about one year later because of burning about the anus and diarrhea. She exhibited the classi-

cal evidence of multiple vitamin deficiencies. Roentgen examination revealed segmental dilatation of the jejunum and ileum with tendency to constriction. The entire colon was narrowed. Because of the involvement of the whole gastrointestinal tract, it was decided that surgical intervention was inadvisable and accordingly chronic hospitalization was recommended.

She was admitted to Montefiore Hospital and died after seven months.

Anatomic Diagnosis. Status post jejunotransverse colostomy for ileitis; status post resection of ileum, cecum and ascending colon; amyloidosis of spleen, kidneys and adrenals, and amyloid nephrosis, small tuberculous caseous focus in the left lung.

Microscopic examination (jejunum) showed "one area of homogeneous, pale, pink-staining material about some of the capillaries and small arteries in the tunica propria, may be amyloid."

Case III. *Acute Ulcerative Jejuno-ileitis. Dormant Ulcerative Colitis. Amyloidosis.*

J.N. This man, aged twenty-nine, was admitted in November, 1942, because of recurrent diarrhea for ten years. In 1933 he had been hospitalized elsewhere for abdominal cramps, diarrhea of six to eight loose, watery stools per day with occasional blood and weight loss. A diagnosis of tuberculous enteritis was made although roentgenograms of the chest were negative. After medication and sunlight therapy, movements were reduced to about three daily. Later, diarrhea, cramps, weight loss returned as well as pain and drainage about the rectum.

Several months later he was admitted to another hospital for the same complaints and remained there approximately two years. Rectal examination revealed a flat condylomatous mass on the left side of the anus which extended 5 cm. into the rectum. The stool was full of gross blood; no amebae; culture negative. A biopsy of the skin from the rectal area was reported as tuberculosis with typical epithelial proliferation. Excision of perianal fistula showed chronic suppuration with granulomatous changes. Roentgenogram of the chest negative. Barium enema—very advanced colitis involving almost the entire colon, probably ulcerative in type. Proctoscopy—polyposis. While in that hospital he had occasional temperature rises to 101 and 102.3° F. He was placed on a low residue, high caloric and high vitamin diet. Pain and discharge continued from the anal, fistulous lesion—at first considered to be tuberculosis but later thought to be due to ulcerative colitis. Cramps, diarrhea and weight loss continued for months in spite of medication directed against them. Incision and drainage of pararectal abscesses were carried out. Weight fluctuated while in the hospital and when he was finally discharged his weight was 124 lb. as against 110 on entry two years before.

Subsequently he had intermittent diarrhea, usually associated with an upper respiratory infection. He was well in the summer months, but the exacerbations returned in the winter. Seven to eight months before entry he noted sores at the corners of his mouth. For two weeks before entry, during an attack of grippe, severe diarrhea, cramps and vomiting supervened and there was a 12 pound weight loss in a week. For these reasons he sought admission.

Physical Examination. An emaciated man who appeared acutely and chronically ill. Tongue smooth, beefy red and fissured, cheilosis. Lungs clear. Heart, soft systolic murmur at the apex. Blood pressure 90/50. Abdomen negative. There was early clubbing of the fingers and toes.

Laboratory Data. Hemoglobin 75 per cent. White blood cells 2,200 per cu. mm., with marked shift to the left. Stool, guaiac positive. Albumin 2.3 gm. and globulin 1.7 gm. Other blood chemical determinations were normal. Agglutinations for dysentery were negative.

Course. At first was marked by irregular spikes of temperature and liquid, bloody diarrhea of ten to fifteen movements per day. Nine days after entry he complained of sticking pain in the left lower chest. Abdominal distention appeared and progressed and finally respirations became rapid and shallow. The pulse became imperceptible, general tenderness developed all over the abdomen and it was felt that a perforation had occurred. He died soon after.

Postmortem examination revealed chronic ulcerative colitis (relatively dormant), hyperacute jejuno-ileitis with a high jejunal perforation, fecal peritonitis (generalized) and generalized amyloidosis. Practically all organs showed some amyloid tissue.

Comment. "The extensive ulcerative jejunoileitis has been completely investigated as to cause. The mesenteric arterial tree did not reveal changes which could account for so severe a lesion. Amyloid was thought of, but the early

ulcerations which were especially examined did not show evidences of amyloidosis. The cytology of the ulcer is not characteristic of any of the known granulomata. Bacteriologic studies did not reveal any unusual type of bacterium. The lesions therefore have to be classified as 'nonspecific.' " (Dr. P. Klemperer)

DISCUSSION

It is generally agreed that the majority of cases of nonspecific ulcerative colitis begin around the rectosigmoid. However, approximately 5 to 15 per cent of the cases show involvement of the segmental type which more often occurs on the right side. It is also well known that occasionally the disease process may pass the ileocecal valve to involve the terminal portion of the ileum.[3,19] McKittrick and Miller,[15] in a review of 149 cases, stated that in 1.3 per cent the disease process extended into the terminal ileum. Schlicke and Bargen[21] in a study of fulminating ulcerative colitis reported that at necropsy all their fatal cases showed diffuse involvement of the entire large bowel: only one showed lesions in the terminal ileum; how extensive was not stated. There were 2 case reports[5,6] of individuals suffering from ulcerative colitis with extension to the ileum but the extent of involvement was not mentioned.

The only report found in the literature describing involvement of the small intestine by chronic ulcerative colitis beyond the terminal foot or two of ileum is that of Crandon *et al.*[8] They reviewed 16,500 consecutive autopsies from the Mallory Institute. There were 44 cases in which chronic ulcerative colitis was considered the primary cause of death. In 17, or 39 per cent, the small intestine was involved; in the majority it was confined to the terminal 30 cm. of ileum. In 3, however, ulceration extended throughout the lower third of the ileum. In addition, they stated that the incidence of perforation of the small bowel in ulcerative ileitis was 24 per cent. They described 2 cases in which at operation the ileum looked normal but perforation occured after ileostomy. In 1 case, it was involved 60 cm. above the ileocecal valve; in the other, lesions were noted 30 cm. above the ileocecal valve, 15 cm. above the site of the ileostomy. The ileum grossly showed the same diffuse process which was seen in the colon. The ulcers were sharply demarcated and varied in size and shape. Microscopic examination revealed the mucosa to be absent or necrotic. There was edema and thickening of the submucosa with marked polymorphonuclear and lymphocytic infiltration in the muscularis like the lesions in the colon. They point out that in cases where the ileostomy drainage does not become solid, one should be suspicious that there is involvement above the ileostomy with consequent danger of perforation and peritonitis.

Cases II, III, and IV were also complicated by amyloidosis. This is an unusual finding. No reports have been found in the literature in which amyloidosis has complicated regional enteritis. Moschcowitz[16] reported a case of ulcerative colitis with amyloid degeneration. The only other report found is that of a young man with severe ulcerative colitis who also had amyloid degeneration of the kidneys, liver, spleen and adrenal glands.[7] The rarity of amyloidosis is curious when one realizes that both chronic ulcerative colitis and chronic enteritis are long standing diseases characterized by persistent infection. There is no apparent reason why amyloid occurred in the present cases and not in others where there were extensive abscesses and suppuration. It is within the realm of possibility that more instances occur than is suspected. There is recorded in our autopsy files a case of long standing ileitis where the main complication was a huge retroperitoneal abscess which persisted in spite of all surgical and chemotherapeutic measures. Postmortem examination disclosed a huge retroperitoneal abscess with lumbar osteomyelitis. In addition there was amyloid degeneration, the pathogenesis of which could not be determined.

The clinical manifestations of gastrointestinal amyloidosis have been adequately discussed in the literature.[2,14,18,19] There are

several cases reported in Henke and Lubarsch[13] of patients with amyloid disease without ascertainable cause who died of gastrointestinal bleeding. It is also mentioned that in amyloid disease the intestine usually participates and the deposition in the muscles causes paralysis of peristalsis with mechanical obstruction resulting therefrom. The present cases emphasize that some of the intestinal symptoms in the occasional case of long standing enteritis and ulcerative colitis may be due to amyloidosis.

Case iv. *Nonspecific Enterocolitis.*

S.K., a twenty-five year old married furniture salesman, was admitted to The Mount Sinai Hospital in 1941 complaining of abdominal pain and fever for four months. Past history revealed a 15 pound weight loss in the four months preceding entry, an appendectomy eight years ago with no unusual features, and several episodes of red swellings on the right thigh associated with fever. Four years ago he noted the gradual onset of anorexia, malaise, fever and diarrhea. The diarrhea greatly increased in severity so that after six months it amounted to twelve watery movements per day without blood. In addition, he now had daily elevations of temperature to 103–104° F., marked anorexia, weakness, 90 pound weight loss, and generalized abdominal tenderness. He was admitted to another hospital where he was given a high caloric diet, transfusions, and supportive therapy. He was there for nine weeks and gradually improved. After discharge the improvement continued and he gradually attained his former state of health. He was well for a year and then had a mild recurrence for six months with complete recovery. Four months before entry, he began to run a low grade fever and diarrhea returned. He was put to bed and given kaomalgin and sulfathiazole for a seven week period. He improved upon this therapy, but because of persistence of the fever, was referred to the hospital.

Examination showed a well developed and well nourished male. Temperature 100.4° F. Pulse 74 beats per minute. Respirations 18 per minute. Blood pressure 135/85. Lungs were clear. Heart showed a reduplication of P-2. The abdomen was slightly distended with a well healed right lower quadrant scar. There was some tenderness in both lower quadrants. Rectal examination was negative and there was slight clubbing of the fingers.

Laboratory Data. Hemoglobin 102 per cent. Red blood cells 6.3 million per cu. mm.; white blood cells 11,600 per cu. mm., with 20 nonsegmented forms and 45 segmented polymorphonuclears; 280,000 platelets per cu. mm. Urine negative. Blood urea nitrogen 11 mg. per 100 cc. Fasting blood sugar 80 mg. per 100 cc. Icteric index 3. Dysentery agglutinations negative. Wassermann reaction negative. Stool culture negative Electrocardiogram negative. Roentgenogram of the chest negative. Sigmoidoscopy normal.

Barium enema showed no abnormalities in the large bowel. Barium meal examination showed "the stomach and duodenum to be normal. The terminal ileum for a distance of about 5 inches is constricted, the margins serrated. The appearance is that of regional ileitis" (Fig. 3).

The patient ran a fever of about 101° F. daily and had one or two semisolid or solid stools a day. He was given sulfathiazole for eight days without any effect. After three weeks of observation, he was explored (Dr. L. Ginzburg). "Beginning at the ileocecal junction, the first foot of ileum was like a pipe. The walls were thick, edematous, and rigid, as was the mesentery. The second foot was more nearly normal, but there was also slight edema of the wall. The third foot of ileum and mesentery were exactly similar to the first foot. Beginning about a foot from the ligament of Treitz, about 12 inches of jejunum were thick, stiff, and the mesentery was thickened exactly like the picture seen in the terminal foot of ileum. The intravening gut was not absolutely normal, but showed slight thickening and edema of the wall. There were hemorrhagic blotches and moderate enlargement of the lymph glands throughout the mesentery. Because of the extensiveness of the disease, it was impossible to do any operative procedure." His postoperative course was uneventful. His temperature subsided. He had one to two solid stools a day and he left on the sixteenth hospital day, apparently in a remission of his illness.

The patient did very well for approximately six months when he was once again admitted to another hospital for symptoms of obstruction but he was not subjected to any operative procedure. Following this, his general condition re-

mained good for the next three years although another roentgenogram taken one year after discharge from The Mount Sinai Hospital gave the impression that the diseased loops of intestine were somewhat more rigid and narrowed (Fig. 3). There was, however, no delay in motility. About a year before readmission to The Mount Sinai Hospital, in March, 1946, he again noted gradual weight loss and anorexia.

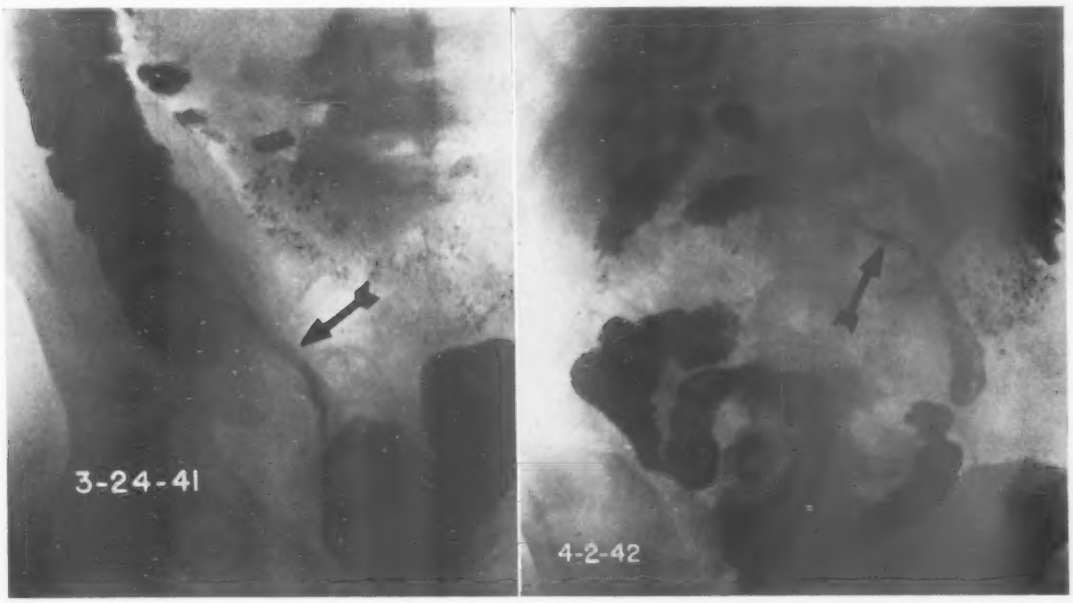

Fig. 3. Case iv. 3/24/41, stenosis of terminal ileum; 4/2/42, apparent stenosis of jejunal loop.

Three months before entry, there was an increase in the number of stools so that he was having six to ten loose stools per day. There were occasional episodes of fever and chills at night with elevation of temperature to 101° F., with return to normal in the morning. In addition, during the past few weeks, he had generalized abdominal cramps relieved by passage of gas or by having a bowel movement. There was a 35 pound weight loss in the last year.

Physical Examination. Temperature 102.6° F. Pulse 86. Respirations 22. Blood pressure 115/75. Examination showed a thin, poorly nourished white male with evident signs of dehydration. There were no abnormalities in the heart or lungs. The abdomen was slightly distended with diffuse tenderness and general tympanitis. The liver percussed two fingers below the costal margin.

Laboratory Data. Stool watery; guaiac test 2 plus, no free fat seen, many pus cells. Urine negative. Hemoglobin 50 per cent. Red blood cells 3.9 million per cu. mm. White blood cells 9,300 per cu. mm., with segmented forms 53 per cent; non-segmented 28 per cent; lymphocytes 15 per cent; monocytes 5 per cent. Blood urea nitrogen 14 mg. per 100 cc. Chlorides 575. Carbon dioxide 47 volumes per cent. Total protein 5.1 grams. Cholesterol 100 mg., calcium 8.2 mg., phosphorus 2 mg. per 100 cc. Roentgen examination of the gastrointestinal tract showed considerable dilatation of the small intestine (Fig. 4). Barium enema showed an ulcerative colitis involving at least the sigmoid and descending colon. The bowel was somewhat narrowed in this region. Its edges were serrated and post-evacuation films showed evidence of polypoid hyperplasia. Portions of the ileum were visualized and showed areas of constriction and dilatation.

Throughout his hospital stay he ran a septic course with temperatures ranging as high as 103° F. His stools continued unchanged. During the second hospital week, he developed signs of peritonitis, with high fever and marked abdominal distention. Wangensteen drainage and transfusions proved unavailing and he died on the twentieth hospital day.

Postmortem examination revealed serofibrinous peritonitis. There was a diffuse enterocolitis

involving the gastrointestinal tract from jejunum to sigmoid with ulceration, edema and scarring.

Gastrointestinal tract: The esophagus is not dilated. There are several superficial mucosal ulcerations, the largest of which is 1.5 cm. in diameter. The gastric mucosa presents the usual rugal pattern with no evidence of atrophy or other gross changes. There is diffuse hyperemia slightly rigid. The ulcerations and intervening islets of hyperplastic mucosa have a parallel longitudinal disposition. The lumen appears somewhat narrowed. The mesentery of the ulcerated segments is thickened and edematous and contains many large hyperplastic lymph nodes. The appendix is not present.

The entire colon, except in a small dilated portion of the transverse colon, shows diffuse

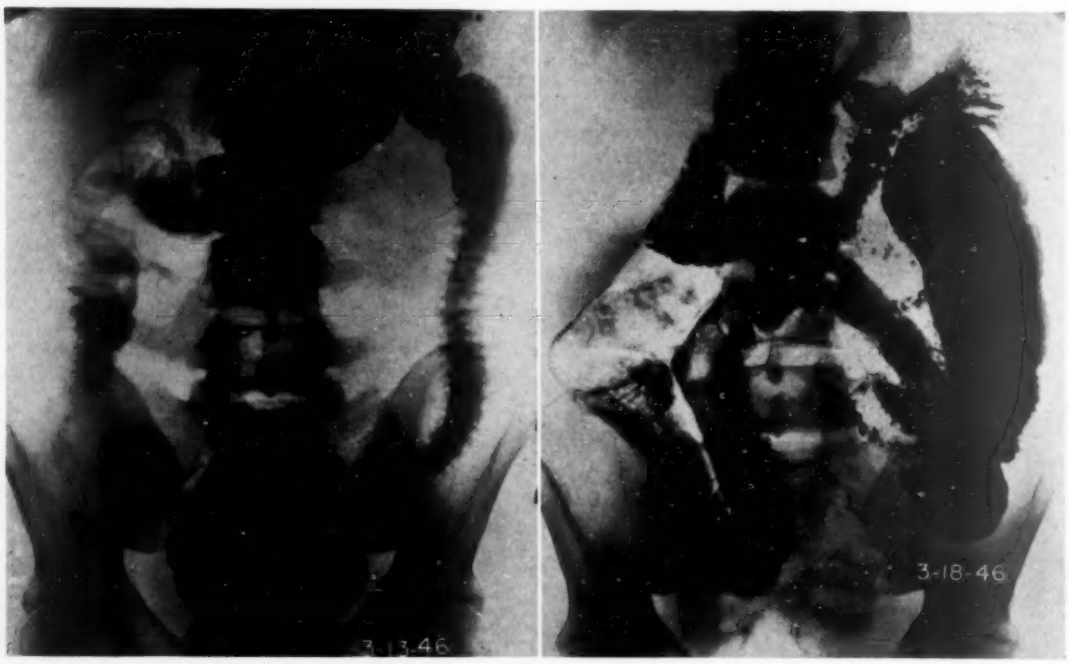

Fig. 4. Case iv. 1946. Dilated small intestine. Typical ulcerative colitis involving the entire large bowel.

of the duodenum without ulceration. The upper portion of the jejunum shows diffuse moderate hyperemia with occasional superficial ulcerations, some of which have undermined edges. In the mid and lower jejunum, the ulcerations are widespread, imparting a honey-combed appearance to the mucosa. Throughout the ileum there are extensive areas of ulceration of various sizes and shapes, frequently involving the entire circumference of the intestine, exposing the muscularis. The intervening mucosal islets are hyperplastic. The entire process in the small intestine is segmental, there being large stretches of ulcer-free bowel, and other areas in which there are many superficial and deep ulcers of varying size and shape and with undermined edges. In many of the ulcerated areas the wall of the small intestine is thickened. This is most pronounced in the terminal ileum which is extensive ulceration with polypoid islets of hyperemic, hyperplastic mucous membrane and marked thickening of the wall. In the dilated segments of the transverse colon, the typical picture of ulceration and intervening islets of hyperplastic tissue is not found. Here the mucous membrane is either intact or there are superficial, fresh ulcerations of various sizes and shapes with undermined edges as found in the small intestine. The wall of this portion of colon is not thickened. The rectosigmoid is diffusely hyperemic and shows several large deep, serpiginous ulcers. The bases of many of the ulcers throughout the intestine are necrotic; those in the descending colon have transverse folds. The serosa of the small and large intestines is focally dull and granular. There are rare, single, firm, dark purple nodules on the surface of the large intestine. No tubercles are found.

Microscopic Examination. Jejunum, ileum and colon: The lesions of the jejunum, ileum, and large intestine are essentially similar and are described together. The ulcers are widespread, usually extending through the mucosa, occasionally through the submucosa to the muscularis propria, rarely all the way through the intestinal wall to the serosa. The edges of the ulcers are punched out, sloping or undermined. There is an associated exuberant chronic inflammatory reaction at the bases and the margins of the ulcers, resulting, in some areas, in conspicuous thickening of the intestinal wall. The reaction affects all the coats, but is most marked in the submucosa. It consists of hyperemic granulation tissue, diffusely infiltrated by large numbers of plasma cells, lymphocytes and large mononuclear cells with the plasma cell predominating. There are small foci of necrotic acute inflammatory exudate on the mucosal aspect of a few of the ulcers. Elsewhere in the intestinal wall proper there is no evidence of an acute inflammatory reaction. The serosa and subserosa are generally markedly thickened and show a chronic inflammatory reaction similar to that in the wall of the intestine, except that the fibrous tissue reaction here overshadows the cellular inflammatory reaction. A membrane composed of fibrin, polymorphonuclear leukocytes, large mononuclear cells, and a few multinucleated cells is present on the peritoneal surface of many of the sections, superimposed upon the chronically inflamed and thickened serosa. The mesenteric and pericolic fat share in the chronic inflammatory reaction, but to a lesser extent than that present in the intestinal wall.

Nowhere in the intestine is a granulomatous response in evidence. No parasites are seen and special bacterial stains showed gram-positive and gram-negative bacilli and cocci on the mucosal surfaces of many of the lesions.

Terminal ileum: The picture in the terminal ileum differs slightly from that in the rest of the intestine. Here there is diffuse ulceration with one ulcer extending through the muscularis to the serosa. On either side of this deep ulceration the muscularis propria is hyperplastic. The wall of the intestine at the base of the more superficial ulcer consists of chronically inflamed granulation tissue. There is fibrosis of the serosa and subserosa. The chronic inflammatory cellular response is similar to, but less intense, than that seen elsewhere in the intestine.

Dr. Paul Klemperer (Pathologist to The Mount Sinai Hospital) stated that this was contrary to any previous experience he had with "chronic nonspecific granulomatous enteritis."

DISCUSSION

The usual course of nonspecific granulomatous disease of the small intestine through subacute and chronic phases with healing by scarring and subsequent stenosis has been adequately described.[4,9,23] Little mention is made in the literature of possible resolution or of healing without stenosis. Most observers feel that recovery is possible only during the acute stage. Crohn[9] states that the majority of the acute cases resolve but that "once a lesion is established by radiographic evidence, the deformity of the bowel remains whether the clinical symptoms do or do not improve." Donald and Brown[11] report that "the experience at the Mayo Clinic coincides with that of Crohn in that post mortem records do not reveal any instance of healed chronic regional enteritis, although in some cases of acute fulminating disease resolution apparently takes place." Sussman and Wachtel[22] refer to a presumed case of acute jejuno-ileitis with apparent complete recovery. Ginzburg and Garlock[12] reported without details a case in which death occurred due to another cause and where autopsy disclosed complete healing. A search of the literature failed to disclose any other postmortem report of diffuse, subacute or chronic enteritis in which resolution took place.

In 7,642 consecutive autopsies at The Mount Sinai Hospital from 1927 to 1947 there have been 18 cases of granulomatous jejuno-ileitis in which death occurred due to this disease. In 17, typical granulomas with healing by scarring were found. In the present case the lumen of the intestine was not narrowed; there was no significant submucosal fibrosis nor any evidence of a granulomatous process. The argument might be advanced that since a biopsy was not taken at the time of operation in 1942, this is not necessarily a case of regional enteritis. In

favor of the diagnosis was the usual roentgen appearance of stenosis of jejunal and ileal loops both in 1941 and 1942—five and four years respectively before death. The colon roentgenologically appeared normal at these times. There is also the evidence of the surgeon, who had particular experience in this disease, that "the first foot of ileum was like a pipe," "the third foot of ileum and . . . about 12 inches of jejunum were thickened and stiff." These descriptions correspond to what ordinarily would be considered granulomatous disease. On the other hand, the surgeon might have been deceived by the induration of edema and ulceration. Certainly these could have accounted for the roentgen appearance.

The case might correspond to those reported by Ginzburg and Garlock[12] and by Alvarez[1] in which extensions into the colon from chronic enteritis occurred. However, in their cases the small intestine remained stenosed. A further possibility is that the case is one of primary ulcerative colitis with small intestinal involvement but the course would be most atypical. It would have to be assumed that the small intestine was the predominant site of the disease for five years and that colonic involvement became apparent only shortly before death. For these reasons we suggest tentatively that a more general designation, nonspecific enterocolitis, to be given to this case.

Four Cases of Ulcerative Colitis with Extensive Small Intestinal Involvement.

Case v. T.L. This was the first Mount Sinai Hospital admission of a nineteen year old girl for diarrhea, vomiting, anemia, and rectal bleeding. Past history was essentially negative. She had been trying to become pregnant for eight to nine of her nineteen months of married life, and five months before entry she conceived. A month later, she began to vomit several times a day and this continued with increasing severity. A month later, she began to have five to six watery bowel movements per day and this persisted. After a few weeks she began to pass three to four teaspoonfuls of red blood with the stools. She lost weight and strength markedly, and her condition deteriorated in spite of iron and copper medication. Three weeks ago, she ran a temperature to 101° F. daily. After five days, her normal pallor increased and her temperature rose to 103° F. Her physician gave her 5 grain tablets of sulfanilamide and cyanosis resulted. She was taken to a local hospital and given a blood transfusion. Temperature rose to 106° F., she had a shaking chill; cyanosis and icterus appeared, and she aborted spontaneously five days later. She bled profusely and received a second transfusion. Chill and temperature elevation to 104° F. resulted. Two days before she was transferred to The Mount Sinai Hospital, her temperature rose to 106° F.

Physical examination revealed a pale, exsanguinated, stuporous, nineteen year old girl. There were hemorrhages in both fundi. The lungs and heart were not remarkable. The pulse was of the Corrigan type with a pistol-shot sound heard over the femoral arteries. Blood pressure 130/0. Hemoglobin was 14 per cent on admission and red blood cells were 1,000,000 per cu. mm. White blood cells 19,000 per cu. mm., with a normal differential. Blood urea nitrogen 49 mg. per 100 cc. Fasting blood sugar 115 mg. per 100 cc. Cholesterol 99 mg. per 100 cc. Cholesterol ester, trace. Chloride 655 mg. per 100 cc. Total protein 4.6 grams. Urine showed occasional clumped white blood cells and an occasional hyaline cast. Blood culture was negative. Electrocardiogram showed sinus tachycardia, rate 130. RS-T transition depressed in leads I, II, III. T-waves low in the standard leads, T-4 diphasic.

Temperature was 103° F. on admission and remained between 103 and 106° F. during her hospital stay. Gynecologic examination revealed no evidence of any pelvic sepsis and there were no abdominal signs of peritonitis. Two days after entry, she showed a bilateral foot drop and diminution in sensory modalities as found in peripheral neuritis. There was a recurrence of rectal bleeding and in spite of practically continuous blood transfusions, her condition became worse and she died eight days after admission.

Postmortem Examination. "The duodenum and upper part of the jejunum reveal no gross changes. The mucosa in the distal part of the jejunum is congested and the signs of inflammation become more severe as one proceeds down the intestinal tract. The mucosa in the lower part of the ileum is a dirty, brownish-red and is covered with necrotic membranous tissue which strips away with ease. The wall of the

bowel is extremely thin. The entire large intestine was the seat of a severe diffuse ulcerated process."

Dr. Paul Klemperer made the following comment on this case: "Pathology of the intestinal lesions is not unusual. Histopathology reveals severe vascular involvement (acute arteritis) of the submucosa of the colon and in the necrotic terminal portion of the ileum. These arteries are within the edematous submucosa and not adjacent to severe inflammation. It cannot be ruled out that the severe vascular lesions are responsible for the destruction of the mucosa."

Case vi. H.P. This twenty year old pharmacy student entered The Mount Sinai Hospital for the second time because of rectal hemorrhages and diarrhea for two years. He had been admitted six months previously for ulcer symptoms. He was kept on medical therapy and was discharged improved. No operation was performed. While vacationing he had occasional attacks of diarrhea and occasionally noted some blood after defecation. On his return he was admitted to the Hospital since a gastrointestinal series supposedly showed an ulcer. He did well till one month ago when he began to have abdominal cramps and slight diarrhea. The number of stools gradually increased and they were now bloody. Because of the increase in symptoms with loss of weight and with fever he was admitted again.

Physical examination revealed a pale, chronically ill-appearing male complaining of abdominal pain. Temperature 101.8° F. Pulse 112. Respirations 22. Blood pressure 110/80. There was a soft apical systolic murmur. Abdominal examination revealed slight left lower quadrant tenderness and moderate distention. There was diffuse tenderness on rectal examination. It was felt that he was suffering from chronic nonspecific ulcerative colitis.

Laboratory Data. Erythrocyte sedimentation rate 71 mm. per hour. Hemoglobin 70 per cent. Red blood cells 4.15 million per cu. mm. White blood cells 12,200 per cu. mm., with a normal differential count. Urine showed very faint trace of albumin and occasional red blood cells and white blood cells on microscopic examination. The chemical determinations of the blood were normal. All agglutinations for dysentery organisms were negative. Stool culture revealed *B. coli* and enterococcus. Total protein 4.9 grams. Roentgenogram of the chest was negative. Barium enema revealed ulcerative colitis involving the large intestine from the cecum to the region of the splenic flexure. In the descending colon the mucosal pattern showed an irregularity in that the longitudinal striations were fuzzy in outline, presumably due to the same disease. Sigmoidoscopy showed marked involvement with large and small ulcers with free bleeding.

Intensive therapy had no influence on his disease. After six weeks he showed no improvement; diarrhea continued, fever persisted, hemoglobin kept falling and the weight loss continued. Ileostomy was decided upon as the only possible hope to stay the rapidly retrogressive course. He did fairly well immediately after ileostomy, but on the fifth postoperative day he began to have marked rectal bleeding. The following day marked abdominal cramps started, accompanied by distention and moderate tenderness in the left lower quadrant. The distention increased and a yellow serous discharge came out around the ileostomy. His course was relentlessly retrogressive, signs of peritonitis increased and he died on the tenth postoperative day.

Anatomic Diagnosis. Status post ileostomy for ulcerative colitis—ten days; subacute ulcerative colitis of entire colon with three perforations in cecum and transverse colon; ulcers of ileum with perforation; generalized serofibrinopurulent peritonitis.

Gastrointestinal Tract. The duodenum, jejunum and ileum are extremely distended. Their mucosa shows in several instances hemorrhagic areas. The mucosa of the ileum shows four sharply punched out deep ulcerations, each of which measures 3–4 mm. in diameter. One of these ulcers has perforated into the peritoneal cavity. The wall of the small intestine is extremely edematous. The ileum is transected 5 cm. proximal to the ileocecal valve. The entire colon is the seat of extensive changes.

Case vii. C.A. The first Mount Sinai Hospital admission of a twenty-six year old shipping clerk for bloody diarrhea of five years' duration. Past history was essentially negative. Five years ago he first noted onset of diarrhea; stools were formed but contained streaks of blood and mucus. He went to another dispensary where various forms of therapy were tried, but the diarrhea became progressively worse. It continued relentlessly for a year and he finally was hospitalized and remained so for five months. He received some benefit only from

Bargen vaccine and at discharge was having only five to eight semiformed stools per day. He continued the vaccine therapy at home but did not seem to improve much more. After a year he went to another physician who tried autogenous stool vaccine, also without much success. Several transfusions seemed to give temporary aid. In the past six to eight months the diarrhea became very severe and he was having twenty to twenty-five bloody stools per day. In the last few months he noted some exertional dyspnea with crampy pain in the arms and legs, coming on spontaneously. Ankle edematous, friable, rectal mucosa, but no ulcerations were seen.

Because of the lack of response to any therapy, an ileostomy was deemed advisable and he was prepared for this operative procedure by many transfusions. When the hemoglobin reached 69 per cent, an ileostomy with division of the ileum was carried out. He did well until the sixth postoperative day when he had a generalized convulsion characterized by cyanosis, abdominal twitching. Carpopedal spasm was present, but there was no Chvostek sign. In spite of intravenous calcium medication he had three more seizures and became semicomatose. A neurological consultant felt that these were toxic manifestations. His abdomen became distended, the pulse faded and he died.

Fig. 5. Case viii. Constant deformity and apparent stenosis of terminal ileum.

swelling was present for the last month before entry into The Mount Sinai Hospital.

Physical examination revealed an anemic, emaciated male complaining of diarrhea. Temperature 99.2° F. Pulse 88. Respirations 20. Blood pressure 110/80. There was a soft apical systolic murmur. The abdomen revealed a slightly tender, spastic sigmoid; the left kidney was palpable. There was moderate ankle edema, but examination was otherwise negative.

Laboratory Data. Hemoglobin 25 per cent. Red blood cells 2,500,000 per cu. mm. White blood cells 7,000 per cu. mm., with 80 per cent polymorphonuclear leukocytes. Urine was negative. Wassermann reaction was negative. Blood urea nitrogen 10 mg., fasting blood sugar 75 mg., cholesterol 135 mg., calcium 8.8 mg., phosphorus 4.6 mg. per 100 cc. Total protein 6 grams. Albumin 3.1 grams and globulin 2.8 grams. Stool guaiac test was positive and stool culture revealed *B. coli*. Sigmoidoscopy—

Postmortem Examination. "Beginning in the distal portion of the jejunum and extending throughout the most of the ileum with only a few small areas being excluded, the mucosa presents a distinctly purplish red color. Throughout there are many shallow transverse situated ulcerations. Peyer's patches are considerably enlarged and contain punched out areas. There are also areas in which there are granular greenish and reddish deposits on the mucosal surface. The distal portion of the ileum is not involved. From the hepatic flexure down, the appearance is that of chronic nonspecific ulcerative colitis."

Case viii. M.C. This forty year old taxi driver entered The Mount Sinai Hospital for

the first time in January, 1944, complaining of diarrhea, occasionally associated with streaking of blood and abdominal cramps. He was given a constipating diet and sulfaguanidine, but the diarrhea was not relieved. Sigmoidoscopy was done by his physician and was negative. He was referred to the hospital as a possible right-sided colitis.

Physical examination showed a moderately well developed, well nourished man with clubbing of the fingers. There was a soft systolic blow on the aortic area. A right direct and indirect inguinal hernia was present.

Laboratory Data. Hemoglobin 93 per cent. White blood cells 11,300 per cu. mm., with 73 per cent polymorphonuclear leukocytes. Stool guaiac test was negative. Erythrocyte sedimentation time fifty-eight minutes. All agglutinations were negative. Barium enema showed an increase in the haustral markings of the large bowel without evidence of ulceration or change in the mucosal pattern. Irritability of the caput coli and the terminal ileum was noted (Fig. 6). A small intestinal series showed a constant irregularity and irritability of the terminal ileum and a deformity of the caput coli considered to be due to granulomatous disease (Fig. 5). Stools were persistently guaiac positive. They gradually became formed and less in number. The temperature which had been 103° F. on admission fell to normal on the fourth day. He gained 10 pounds and became asymptomatic.

In two months he returned because of recurrence of his symptoms three weeks after discharge. Physical examination was essentially as on the first admission except that now the spleen was just palpable. He was operated on by Dr. G. D. Oppenheimer on April 12, 1944. The surgeon found that "the terminal 3 feet of ileum were congested, dull, thickened and mushy to palpation. The small bowel above this was normal. Similar disease was seen in the cecum, ascending, transverse and descending colon down to the middle of the sigmoidal segment. The ileum was divided about 4 feet from the ileocecal valve and an ileorectosigmoidal anastomosis was made." The patient did well postoperatively and was discharged after three weeks with stools which were formed and non-bloody but frequent. This was explained on the basis of low implantation of the ileum in the rectosigmoid.

He returned in six weeks for an ileocolic re-

Fig. 6. Case VIII. Mucosal pattern of large intestine within normal limits. In retrospect, some fragmentation of the pattern is suggested.

section. Since discharge he had had eight to nine movements per day but for the last week before entry they had increased to eighteen to nineteen per day. In addition there had been a 5 pound weight loss, some anorexia and low abdominal pain after bowel movement.

Physical examination revealed a thin, chronically ill, cyanotic man with marked clubbing of the fingers and toes. Liver and spleen were now both palpable one finger below the costal margin, and rectal examination revealed a spastic tender rectum with large areas of scarring but no palpable ulcerations. Sigmoidoscopy showed normal mucosa for a distance of 22 cm. Hemoglobin 89 per cent. White blood cells 13,000 per cu. mm., with a normal differential count.

The patient was explored with the intention of dividing the sigmoid in preparation for a subtotal colectomy and terminal ileectomy. At operation the free sigmoid above the anastomosis was found to be thickened and badly diseased. The anastomosed ileum was thickened and diseased for about 6 inches proximally. The anastomosis was taken down, the sigmoid turned in and the proximal sigmoid and ileum were brought out as stomas on the abdominal wall. Examination of the resected 25 cm. of ileum showed the following: "Specimen consists of a loop of ileum with mesentery measuring 25 cm., half of which shows severe ulceration in a general transverse direction with the

base of the ulcers grayish and the wall of the ileum very hemorrhagic. In the area where the ulcerations are the severest, the bowel was torn. Near this end there is an anastomosis, a short loop of colon not more than 2.5 cm. being anastomosed to the ileum. There are still sutures present in the anastomosis. The mucosa of the anastomosed colon is pale but shows some small defects.

"Pathologic diagnosis: Segment of ileum showing extensive nonspecific transverse ulcerations with foreign body granulomata in the submucosa."

There was considerable spilling into the peritoneal cavity during the procedure. Peritonitis developed. There was wound separation and formation of a fecal fistula about the ileostomy site. These gradually subsided. In the next six weeks with diet, amigen, and transfusions he regained 20 pounds and re-operation was contemplated in the hope of re-establishing the continuity of the intestinal tract. However, he developed many episodes of intestinal obstruction, successfully combatted with the aid of a Miller-Abbott tube. By the end of the second month he no longer showed improvement and his condition gradually grew worse in spite of all measures, and death finally occurred after five months of hospital stay.

Postmortem examination revealed that the ileum was divided 42 inches above the ileocecal junction. The duodenum appeared normal. The portion of the ileum up to the ileostomy was extremely dilated, moderately thickened, the mucosa was dark red and swollen with prominent plicae circulares. The mesenteric lymph nodes were enlarged, discrete, firm, shotty, and on section were uniformly pale. The terminal and excluded ileum was thin walled; the mucosa was thin and dark red with a moderate number of small, sharply punched out irregular ulcerations reaching down to the muscularis. The cecum, appendix and entire colon were all involved in an ulcerative process which was most severe in the cecum and gradually diminished in severity distally.

Microscopic Examination. Four sections of colon show characteristic changes of ulcerative colitis; the excluded ileum, multiple ulcerations.

Comment. Cases v to viii again illustrate that chronic ulcerative colitis may involve the small intestine much beyond the terminal foot or two, and that jejunum and ileum may be involved in spite of a normal terminal ileal segment. It is important for the surgeon to realize this fact so that when he does an ileal anastomosis or an ileostomy he will be sure to be well above any diseased area in the small intestine. The nature of the small intestinal involvement is not determined definitely from the present cases. In one case the lesions might have been due to shock.[17] In another, amyloid might have played a part but this is unlikely. Presumably then the changes are of the same nature as those in the colon. The condition may be mistaken clinically and roentgenologically for granulomatous ileocolitis. Case viii particularly illustrates that a thickening and edema of the small intestine wall may result in the roentgen appearance of stenosis. This finding, along with cecal deformity, ordinarily has suggested granulomatous disease.

CONCLUSIONS

1. A case is presented of apparent chronic granulomatous jejuno-ileitis which at postmortem examination five years later showed no evidence of this disease. There was, however, at postmortem examination an enterocolitis of undetermined nature. The lesion in the large intestine was classified as ulcerative colitis.

2. Chronic granulomatous disease of the small intestine until now has been considered to be characterized by stenosis. The present case indicates the possibility that resolution without stenosis might take place. The alternative explanation is a disease, possibly a variety of ulcerative colitis, in which the small intestinal lesion dominated the roentgen findings, passing through a phase of thickening and rigidity to a normal or thin small intestinal wall.

3. Two cases of granulomatous jejuno-ileitis and one of ulcerative colitis with amyloidosis are presented. It is suggested that amyloidosis in chronic enteritis is more frequent than has been suspected and might account, in part at least, for the clinical and roentgenographic findings in occasional cases of granulomatous disease.

A review of the literature also suggests the possibility that some cases considered primary amyloidosis might be instances of amyloidosis secondary to chronic enteritis.

4. Five cases are reported of extensive involvement of jejunum and ileum in ulcerative colitis. While in one case there was the possibility that the small intestinal lesions were due to shock, and another was complicated by amyloidosis, it seemed likely that at least the remaining cases represented extensions of the primary colonic disease.

5. The roentgen appearance of stenosis in the small intestine does not necessarily indicate granulomatous disease. Even in the absence of disease of the terminal ileum, ulcerative colitis cannot be excluded despite the lack of distinct roentgen evidence to indicate its presence in the large intestine. Presumably the small intestinal deformity is due to edema and infiltration without significant fibrosis.

6. These observations indicate that it is difficult to determine the type of enterocolitis from the roentgen appearance alone, and that even with postmortem data the pathogenesis may not be ascertainable.

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REPORT OF A CASE OF AN ANOMALOUS LOBE OF THE LIVER*

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THE following case is reported because of the scarcity of similar examples in the literature and because of the interesting problem in differential diagnosis which it presented.

A review of the literature revealed 2 examples of anomalous or accessory lobes of the liver derived from the right lobe and projecting upward from the diaphragmatic surface. Kornblum and Stephenson[3] reported a case of anomalous enlargement of the right lobe of the liver in a sixteen month old female infant who died of a septicemia and bronchopneumonia. During life the chest roentgenograms had shown a large dense area extending upward from the right dome of the diaphragm in a gentle curve which was interpreted to be an interlobar empyema. At autopsy an anomalous enlargement of the right lobe of the liver was found. Of incidental interest was a dissecting hematoma of the right phrenic nerve. In the discussion the authors quote Piersol as stating "one peculiar form of liver occasionally met with shows great increase of the right lobe particularly in a vertical direction with want of development of the left lobe which is thin and short." H. E. MacMahon is quoted as saying "abnormalities of the liver are uncommon," while Kaufmann's Pathology is quoted as stating "abnormal lobulation is not rare." The authors conclude that "anomalous enlargement of the liver is probably of such rare occurrence as to be of little clinical importance."

Roques and Sohier[5] report a case very similar to the one to be recorded in which a mass projecting from the diaphragmatic surface of the right lobe of the liver of a thirty year old French soldier was shown on roentgenograms following pneumoperitoneum. The lesion had been found on a routine examination and the patient was asymptomatic. The published films included only posteroanterior views which showed an orange-sized smooth mass of increased density projecting from the medial diaphragmatic surface of the liver and clearly separated from the right hemidiaphragm by a clear zone of diminished density. A diagnosis of echinococcus cyst was made and the patient was operated upon. An accessory lobe of the liver was found arising from a normal right lobe. The authors found 2 similar cases in the French literature, 1 in a female.

Chouke[2] reported an anomalous division of the right lobe of the liver without disturbance in external contour discovered at autopsy in a twenty year old female.

CASE REPORT

On July 11, 1946, a twenty-four year old aviation machinist 1/c was admitted to this hospital without symptoms because of a soft tissue mass above the right hemidiaphragm discovered on a routine roentgenogram of the chest at a separation center. He denied any serious illness in the past and had recently served on active duty in the Philippines, Palau and Saipan. A film of the chest made approximately a year before was said to have shown a similar lesion but unfortunately neither the film nor the report could be obtained.

Physical examination revealed a well nourished white male. Temperature, pulse and respirations were normal. There was slight decrease in tactile fremitus at the right costophrenic angle posteriorly and the percussion note was slightly dull in this area. No abdominal masses were palpable and there was no lymphadenopathy. The skin and genitalia were normal.

Laboratory studies included a normal red blood cell count and hemoglobin. The white

* The opinions and assertions contained herein are the private ones of the writers and are not to be construed as official or reflecting the views of the Navy Department or the naval service at large.

blood cell count and differential were normal. Urinalysis was normal. A Kahn test was negative. Examination of the stools revealed no evidence of ova or parasites. A tuberculin test was positive.

Roentgen Findings. The roentgenograms taken at the separation center were obtained and showed a smooth oval soft tissue mass about 5 cm. in greatest diameter arising from the posteromesial portion of the right hemidiaphragm and protruding into the pleural cavity. On roentgenoscopic examination there

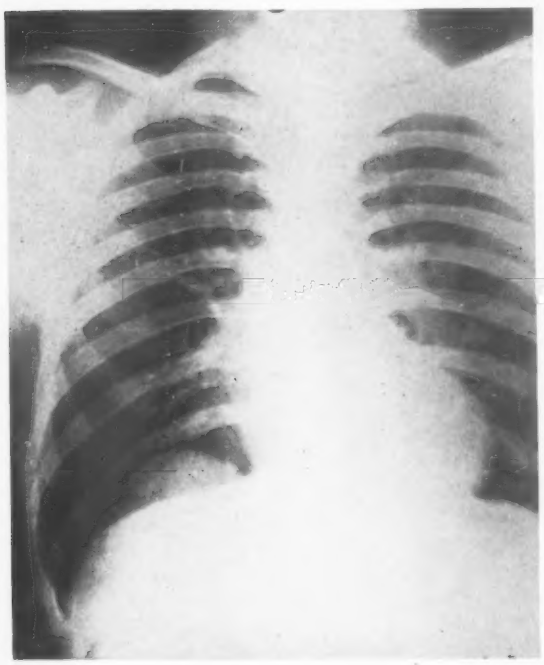

Fig. 1. Posteroanterior view of chest on admission.

was normal motion of the right hemidiaphragm in the supine and the erect positions and on quiet and forced respiration. The soft tissue mass showed no significant change in size or contour during respiration.

A roentgen examination of the upper gastrointestinal tract was negative and an intravenous urogram was normal. In an attempt to determine the origin of the mass a pneumoperitoneum was performed by Dr. James Finnerty. After 250 cc. of air had been injected into the peritoneal cavity, roentgenograms were obtained in the erect and decubitus positions. These showed clearly that the mass lay below

Fig. 2. Right lateral view of the chest on admission showing the anomalous lobe projecting upward and pushing up the right diaphragm.

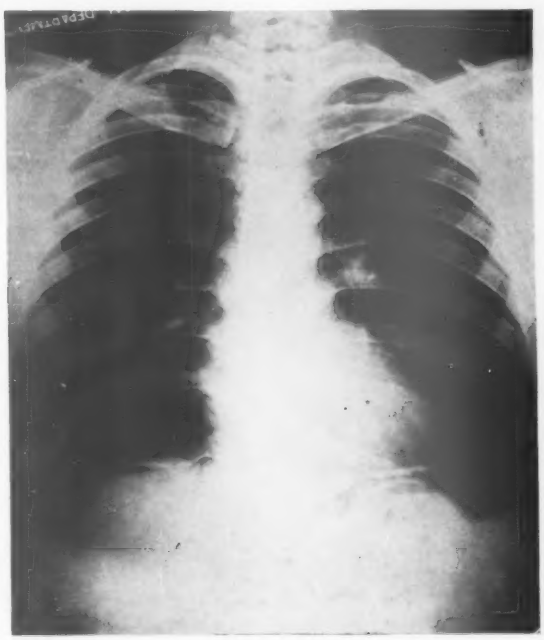

Fig. 3. Following pneumoperitoneum, the very thin diaphragm over the accessory liver lobe has been retouched to demonstrate its position.

the diaphragm and was attached to the superior surface of the liver by a broad pedicle. The portion of the right hemidiaphragm above the mass was very thin. It is worthy of note that roentgenograms obtained forty-eight hours after the pneumoperitoneum showed the lesion to even better advantage probably due to the slower rate of absorption of air around the lesion. A roentgen diagnosis of an anomalous lobe of the liver was suggested with a benign tumor of the liver to be ruled out.

In view of the latter possibility it was decided to explore the patient. While on liberty prior to operation he developed a gonococcus infection of the urethra which responded promptly to penicillin.

At operation, by one of us (E. A. K.), the pleural cavity was entered following subperiosteal resection of the right eighth rib posteriorly. A mass was found protruding into the right pleural cavity at its posteromedial portion, covered by a thinned area of the diaphragm. This was incised and a normal appearing lobe of liver was revealed. The diaphragm was sutured over the anomalous lobe and the pleura closed. The patient's postoperative course was uneventful.

Subsequent roentgenograms of the chest showed the soft tissue mass to be reduced to about one-half its previous size. The patient was discharged to active duty on November 19, 1946.

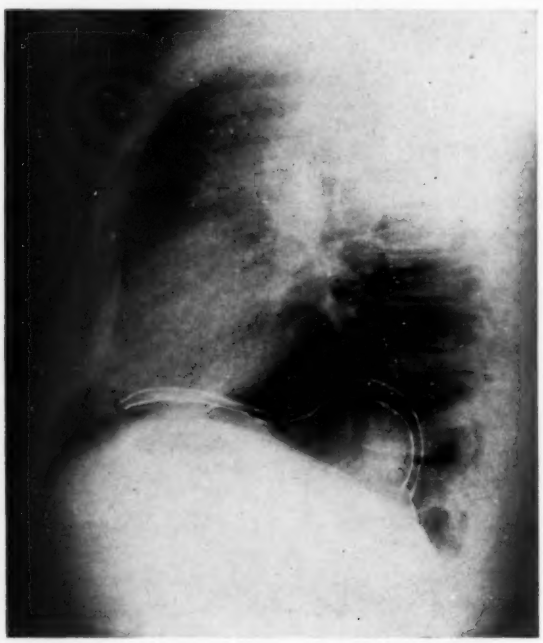

FIG. 4. Lateral view with liver and right diaphragmatic margin retouched to show air between them.

DISCUSSION

The cause of anomalous lobes of the liver is unknown. At one time tight-fitting corsets were thought to be capable of producing lobulation of the liver but this is no longer considered to be a factor. Chouke[2] states that the lobes of the liver grow along the course of the different embryonic veins and that anomalous lobes may be the result of an extra branch of a vein.

The importance of pneumoperitoneum in establishing the location of the lesion in the liver is noteworthy. Stewart and Stein[6] describe the technique of pneumoperitoneum and Carelli[1] published many illustrations of roentgenograms following pneumoperitoneum including several examples of echinococcus cysts of the liver. Pendergrass[4] has recently reviewed the diagnosis of lesions adjacent to the diaphragm and

FIG. 5. View of the upper abdomen made two days after pneumoperitoneum was instituted. The retouched line represents the diaphragm into which the projecting pedunculated accessory lobe of the liver almost completely surrounded by air is demonstrated.

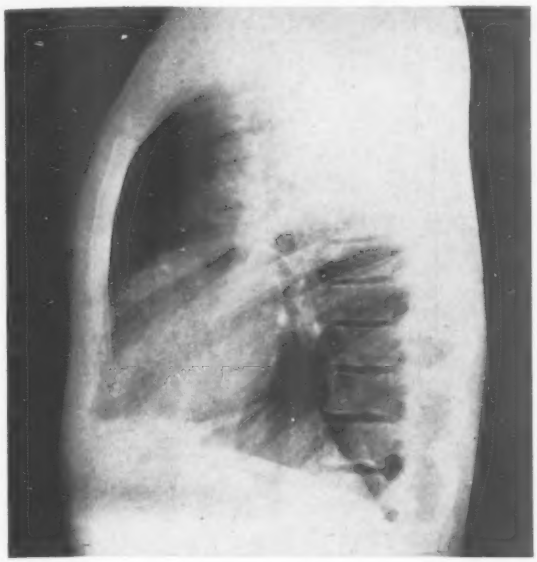

Fig. 6. Right lateral view of the chest following operation, at which time the diaphragm was plicated and sutured over the lobe.

Fig. 7. Posteroanterior view of the chest following operation.

emphasized the importance of pneumoperitoneum.

In the differential diagnosis of such a lesion, the history and physical and laboratory findings are of paramount importance. Gummas should be associated with a positive serologic test for syphilis and clinical evidence of syphilis. Inflammatory lesions should be accompanied by a history of a febrile illness. Echinococcus cysts may be multiple and should be suspected in the presence of a positive complement fixation test and occasionally an eosinophilia. Malignant tumors should increase in size within a reasonable follow-up period. Benign tumors remain difficult to differentiate. Pneumoperitoneum remains the fundamental procedure to differentiate between a lesion of the diaphragm itself and a lesion of the liver. Now that mass roentgenography of the chest is popular it is reasonable to assume that congenital anomalies of this type will be recognized with increasing frequency.

SUMMARY

A case of an anomalous lobe of the liver producing a soft tissue density above the right hemidiaphragm has been presented in which the correct diagnosis was suggested by the roentgen examination, particularly with pneumoperitoneum, and confirmed by operation. Two somewhat similar cases in the literature have been reviewed.

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LEGG-PERTHES' DISEASE: A SYNDROME OF MANY ETIOLOGIES?

WITH CLINICAL AND ROENTGENOGRAPHIC FINDINGS IN A CASE OF GAUCHER'S DISEASE

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THE demonstration of changes in the hips which are characteristic of so-called Legg-Perthes' disease in a patient with a previously established diagnosis of Gaucher's disease, has recently led us to a study of the literature pertinent to both conditions. We found a singular lack of appreciation of the relationship which may and can exist between these two disorders.

From our study, it furthermore evolved that Legg-Perthes' disease is very often not a definite clinical entity, but rather a syndrome of many etiologies. The characteristic roentgenologic picture may be found in a great variety of disorders (symptomatic type). In probably only a relatively small number of instances, the etiology may remain obscure (idiopathic type). Legg-Perthes' disease is, therefore, not in itself a sufficiently satisfactory diagnosis.

According to this concept, the roentgenographic demonstration of a flattened femoral head with a short, wide neck, with or without coxa vara, should always be the starting point for further combined roentgenologic and clinical investigation in an attempt to discover the underlying pathogenic factors. Early recognition of the etiologic mechanism involved is important from both the prognostic and therapeutic standpoints.

REPORT OF CASE

First admission (May, 1929). B.G., a white female Jewish child, aged five, was admitted to the Michael Reese Hospital for study. The mother stated that she had noticed increasing pallor, progressive enlargement of the child's abdomen, and occasional nosebleeds over a period of one year. Four days prior to admission, gross hematuria was observed. Past and family history were non-contributory. Physical examination revealed a well developed but undernourished patient. There was conspicuous pallor, and petechiae were present on the buccal mucosa. Large, non-tender cervical, smaller axillary, and inguinal lymph nodes were present bilaterally. The abdomen was distended and a large spleen was felt extending downward to the iliac crest. The liver was palpable two and one-half fingers below the costal margin. The extremities were freely movable and showed symmetrical brownish pigmentation of the skin over both tibiae. Temperature was 103° F. Examination of the blood showed: hemoglobin 50 per cent (Sahli), red cell count 2.02 million, white cell count 3,050 with 57 per cent polymorphonuclear neutrophils and 43 per cent lymphocytes. Platelets numbered 10,000. The hypotonic saline fragility of the red blood cells was within normal limits. The Kahn test was negative. Urinalysis showed 2 plus albumin with few granular casts and leukocytes, but no red blood corpuscles were present in the sediment. Roentgenograms of the skull and long bones disclosed no pathology.

Five weeks later, a splenic puncture showed typical Gaucher cells. Splenectomy was then performed in order to combat the bleeding tendency. The spleen weighed 570 grams. Histopathologically, typical Gaucher cells were found. The postoperative convalescence was uneventful and the child was discharged to be followed in the outpatient department.

The patient was thereafter admitted to the hospital on numerous occasions over a period of eighteen years. In order to save space, the essential findings are summarized in Table 1.

In 1945, the patient married and in December, 1946, she became pregnant. She felt very well, weighed 110 pounds and walked straight and without much limp. Blood examination:

* The Department of Hematologic Research is supported by the Hematology Research Foundation and the Michael Reese Research Foundation.

TABLE I

SUMMARY OF SIGNIFICANT FINDINGS

Admission	Clinical Findings	Hematologic Findings	Roentgen Findings	Remarks
1st admission May, 1929	Increasing pallor, progressive enlargement of abdomen, nosebleeds, gross hematuria, petechiae, lymphadenopathy, hepatosplenomegaly	Hb 50% (Sahli), RBC 2.02, WBC 3,050 (57% polys, 43% lymph), platelets 10,000. Splenic puncture: typical Gaucher cells	Skull and long bones: no pathology	Splenectomy
2nd admission 18 mo. later	Pain in left thigh with limp and difficulty in walking. Temp. 102° F. Left thigh held flexed, abducted and externally rotated. Tenderness over distal end of femur	Hb 80%, WBC 33,650 (88% polys, 12% lymph.), platelets 140,000	Left femur and knee: no signs of osteomyelitis; 1 month later: periosteal elevation and proliferation with rarefaction of femur	Diagnosis "acute osteomyelitis of left femur." A hole drilled through femur and a small bone fragment removed exposing the marrow cavity; small amount of "pus" found. Path. exam.: bone necrosis. Culture of "pus": only air contaminants
3rd admission Feb., 1931	Pain in right leg apparently following a fall. Temp. 104° F. Epistaxis. Slight tenderness at right knee joint but not along femur	Hb 60%, RBC 2.63, WBC 14,000, platelets 170,000, bleeding time 2 min. Smear: occasional normoblasts	Long bones and spine: no abnormality	
3 mo. later			Changes in both femoral heads and necks involving especially the intertrochanteric region. Impression: hypertrophic osteitis	
4th admission June, 1931	Difficulty in walking. No tenderness over any of the bones or joints. Right leg 1.5 cm. shorter than left leg	Hb 65%, RBC 3.19, WBC 15,350, platelets 270,000	Rarefaction and sclerosis in neck of right femur	Bilateral abduction with traction to correct the coxa vara deformity
5th admission March, 1932	Severe pains in left shoulder		Roentgenograms of left humerus after surgery showed changes in bone texture in entire shaft, but no periosteal reaction	On day of admission operation performed because of diagnosis "acute osteomyelitis of left humerus"; no pus found
1934			Marked thinning, flattening and subluxation of right capital epiphysis with partial destruction of neck. Similar changes present on left side to a lesser degree. Impression: bilateral Perthes' disease	
6th admission Oct., 1937	Generalized aches and pains and temp. of 104° F. Liver palpable 3 fingers below costal margin	Hb 70%, RBC 4.13, WBC 32,900 (59% polys, 32% lymph, 9% mono.), platelets 320,000, bleeding time normal. Tourniquet test negative. Sternal puncture: bone marrow infiltration with typical Gaucher cells	Decrease in density of bones of thoracic spine and coarsening of bony texture. Pelvis: bilateral coxa vara. Right femoral head appeared to have slipped downward and laterally. Metaphyseal zone of neck decreased in density and mottled. Shaft contained many radiolucent cyst-like rarefactions. Left capital epiphysis flattened and changes in the metaphyseal zone as well as cyst-like rarefaction similar to those seen in shaft of right femur present. Lower femur showed typical Erlenmeyer flask deformity	
7th admission June, 1938	Pains in right shoulder. Local swelling and limitation of motion. Temp. 101–102° F.		Shoulder joint negative; humerus showed several well circumscribed pea-sized radiolucent areas in its midportion. Pelvis (Fig. 1): flattening of heads of femurs with widening and shortening of necks; multiple mottled areas of decalcification in upper shafts. Early arthritic changes present in left sacroiliac joint	
8th admission June, 1939	Intermittent pain in right thigh gradually increasing in severity	Hb 60%, RBC 3.38, WBC 17,400 (39% polys, 61% lymph)	Pelvis: intermingled areas of osteoporosis and condensation with excavation of medullary canals of upper femurs and coxa vara deformities. Capital femoral epiphyses had slipped, heads mushroomed in appearance	
Aug., 1940			Pelvis (Fig. 2): progressive changes in left sacroiliac joint. No appreciable changes in remainder of pelvis and hips in comparison with examination of June, 1938	

hemoglobin, 64 per cent; red blood cell count, 3.27 million; white blood cell count, 16,700. Nucleated red cells and Howell-Jolly bodies were present. The liver was enlarged three fingers below the costal margin, but the lymph nodes were not palpable. In March, 1947, the blood showed hemoglobin 72 per cent, red blood cells 3.70 million, white blood cells 9,650, platelets 164,000. Differential count: segmented neutrophils 54 per cent, non-segmented neutrophils 18 per cent, lymphocytes 20 per cent, eosinophils 1 per cent, monocytes 4 per cent,

Fig. 1. June 23, 1938. Note the early arthritic changes in the left sacroiliac joint. The femoral heads are flattened and the necks shortened and widened. There is a bilateral coxa vara. Multiple mottled areas of decalcification are present in the upper femoral shafts. The findings are consistent with a diagnosis of Legg-Perthes' disease.

metamyelocytes 3 per cent. Nucleated red cells, Howell-Jolly bodies and target cells were present.

A roentgenogram of the pelvis (Fig. 3) demonstrated bilateral flattening of the femoral heads, rather severe coxa vara, and areas of radiolucency and sclerosis of the femoral heads, necks, and proximal shafts. The iliac portions of the acetabular fossae also showed signs of

Fig. 2. August 15, 1940. Note the progressive changes in the left sacroiliac joint. There is now early bony fusion. Otherwise, there is very little appreciable change since the last examination on June 23, 1938.

radiolucency and sclerosis. Arthritic changes were present bilaterally. The left sacroiliac joint was markedly sclerotic and almost completely obliterated. Minimal hypertrophic spurring was present in the lower lumbar vertebrae. The lower ends of the femurs (Fig. 4) showed the typical Erlenmeyer flask appearance with a widening of the medullary cavities, thinning of the cortices and numerous areas of radiolucency in the shafts. As an incidental finding, there were discovered some arthritic changes in

Fig. 3. March 13, 1947. Roentgenogram of the pelvis shows severe advanced arthritis in the left sacroiliac joint and also in the lower lumbar spine. Severe articular and juxta-articular changes are present in both hip joints with a semilunar defect in the lateral margin of the left femoral head. The femoral shafts are greatly widened and the cortices are very thin and irregular.

the left knee joint with calcification of the medial meniscus. In the mandible (Fig. 5) were found typical areas of unilocular osteoporosis and apparent disturbance of trabecular structure, as described by Levine and Solis-Cohen.[24]

COMMENT

This patient represents a case of Gaucher's disease which manifested itself at the early age of five with hepatosplenomegaly and symptomatic thrombocytopenic purpura. Splenectomy permanently relieved the patient of the purpura. Further study over a period of eighteen years showed the continued presence of a moderate normochromic normocytic anemia due to bone

marrow infiltration by Gaucher cells, moderate hepatomegaly and the sequelae of splenectomy, e.g., leukocytosis, appearance of nucleated red blood cells, Howell-Jolly bodies and many target cells. These hematologic changes are typical for the post-splenectomy patient as has been shown by Singer, Miller and Dameshek.[38] However, only the involvement of the osseous system was of real significance for the well-being of this particular patient.

As can be seen from the roentgenograms (Fig. 1, 2 and 3), there are present marked bilateral coxa vara, mushrooming of the femoral heads, widening and shortening of the femoral necks and radiolucent defects scattered throughout the femoral shafts. The Erlenmeyer flask appearance of the lower femurs is clearly shown in Figure 4, as well as some arthritic changes in the left knee. The lytic lesions in the mandibles may be seen in Figure 5. The associated changes in the lumbar spine, sacroiliac and lumbosacral joints may be noted in Figure 3, as well as a defect in the lateral margin of the left femoral head which probably represents the result of a rather severe destructive arthritic process.

Given any one of the roentgenograms of the pelvis as a single examination, and disregarding the history of Gaucher's disease, and perhaps the radiolucent shadows in the femoral shafts, the roentgenologic diagnosis could reasonably be Legg-Perthes' disease. All of the necessary criteria are present. As will be pointed out in the general discussion, however, such a diagnosis is probably incomplete in any case which presents such roentgen findings. Certainly in our case, it is essential to the total diagnosis that the patient is suffering from Gaucher's disease.

Our patient was twice subjected to surgery, both times for "acute osteomyelitis" and both times on the day of admission. In each instance, the diagnosis was made clinically and roentgenograms were taken immediately after the surgery. Actually, no osteomyelitis was present on either occasion. This is a rather typical occurrence,

Fig. 4. March 20, 1947. Lower femurs: Marked "Erlenmeyer flask" appearance of both lower femoral shafts, characteristic of Gaucher's disease. There is also calcification in what is probably the left medial meniscus and early arthritic change in the joint.

Fig. 5. March 20, 1947. Left mandible: Distinct osteoporosis of the mandible with apparent disruption of trabecular structure, probably the result of invasion by Gaucher cells. Examination suggested by the case of Levine and Solis-Cohen.[24]

as will be discussed later, and it demonstrates the need for universal appreciation of the clinical findings produced by the "bone crises" of Gaucher's disease.

DISCUSSION

Although so-called Legg-Perthes' disease has been recognized for only a relatively short period of time, the literature concerning this syndrome is quite extensive. The disease was first described by Legg[22] and independently by Waldenström[42] in 1909. In 1910, Calvé[7] and Perthes[30] described the same condition. It was not until 1913, however, that Perthes[31] first offered a clear-cut description of the clinical course and the roentgenographic findings. Since then, further additions to the literature have consisted mostly of attempts to arrive at a uniform concept of the etiology and pathology of the disease.

Because of the diversity of opinion as to the actual disease process, there has been introduced into the literature a number of names for the condition, none of which seems to be wholly satisfactory or adequate to explain its occurrence. The most familiar of these terms is probably Legg-Perthes' disease, sometimes Legg-Calvé-Perthes' disease and sometimes even Legg-Waldenström-Calvé-Perthes' disease. Then there are osteochondritis juvenilis deformans, quiet disease of the hip, pseudocoxalgia, and osteochondrosis, to name but a few. Because of this great variety in terminology and the universally disliked use of proper names applied to diseases, Waldenström,[42] in 1938, suggested the term coxa plana. Valid objections may be raised with respect to the latter term as well, inasmuch as not all cases progress to this end stage of the active disease process.[39] Several authors have been able to show variable degrees of involvement, apparently dependent on the proper and early institution of therapy. Furthermore, Gill[14] believes that the primary location of the disease is in the metaphysis of the femoral neck rather than in the capital epiphysis as postulated by Waldenström.[42]

There is also no unanimity of opinion with respect to the etiology. Brailsford[5] lists the following theories of causation and some of their principal advocates. We have modified and brought this list up to date.

1. Traumatic: Legg,[22] Goldenberg,[16] Pich.[32]
2. Infection or inflammation: McWhorter.[28]
3. Congenital stigmata: Jansen,[18] Müller.[27]
4. Unrecognized congenital dislocation of the hip: Calot.[6]
5. Rickets: Calvé.[7]
6. Rheumatic: Perthes.[31]
7. Endocrine disorders: Cavanaugh, Shelton and Sutherland,[9] Albright.[1]
8. Embolic: Axhausen.[3]
9. Vascular: Bentzon,[4] Zemansky and Lippman,[44] Leriche and Policard.[23]
10. Familial: Kehls.[20]
11. Osteochrondritis similar to Köhler's disease: Brailsford.[5]
12. Alterations in calcium-phosphorus metabolism: mentioned by Cavanaugh, *et al.*[9]
13. Syndrome of many etiologies.

Brailsford presents evidence from his own work and that of others to show that the familial theory is inadequate, that the concept of congenital stigmata is incorrect, that the theory of endocrine imbalance does not explain the incidence in endocrinologically normal individuals. Furthermore, he shows that there is no evidence of either an osteitis or a chondritis to support the infectious theory, that rickets and congenital dislocation of the hip do not apply in a sufficient number of instances. Therefore, none of the theories are completely satisfactory although trauma is the one factor demonstrable in the majority of the cases. Even this explanation is not, by itself, entirely adequate and the concepts of vascular and neurotrophic alterations must also be invoked to complete the requirements of disease causation.

Thus the problem of the etiology of so-called Legg-Perthes' disease remains unsolved. The mere fact that it has been necessary to suggest such diverse factors as endocrine imbalance as opposed to localized infection indicates a lack of real under-

standing of the actual pathogenesis of the disease. According to Gill,[15] it is doubtful that all types of osteochondritis juvenilis are manifestations of the same pathologic process and and due to one and the same cause. In further support of this concept, we suggest the addition of Gaucher's disease to the list of causative factors.

There are numerous reports of the incidence of bone changes in Gaucher's disease. There have even been specific references to the production of changes similar to Legg-Perthes' syndrome, but the relationship is not too well recognized probably because of the relative rarity of this combination. In discussion of Gaucher's disease in the accepted textbooks of roentgen diagnosis, only Archer,[2] citing the case of Reiss and Kato,[36] states that "often there is flattening of the head similar to that in Legg-Perthes' disease."

Ferguson,[12] in his discussion of coxa plana, includes the roentgenograms of 2 cases in which there are marked changes in the femoral heads and necks. Both cases were proved by splenectomy to be instances of Gaucher's disease. From the reproductions, one gets the distinct impression that without the diagnosis of Gaucher's disease having been established, primary consideration would have to be given to Legg-Perthes' disease. Thannhauser[41] confesses just such a reaction on studying the roentgenograms of one of his own cases. Hodges, Phemister and Brunschwig[17] describe a case of Gaucher's disease which shows beginning collapse of the right femoral head. These authors do not state, however, that this is an instance of Legg-Perthes' syndrome produced by Gaucher's disease. The reproductions lead us to believe that such a conclusion might be valid.

One of the cases of Cushing and Stout[10] was thought to have a neurotrophic joint and, after splenectomy, was subjected to a resection of the femoral head and neck. The marrow, however, was almost entirely replaced by Gaucher cells. Santee[37] reports a patient who was treated for tuberculosis of the hip joint. The diagnosis of Gaucher's disease was established by splenectomy. Welt, Rosenthal and Oppenheimer[43] discuss the incidence of bone changes in Gaucher's disease. An analysis of their reproductions shows 3 cases out of 8 in which there is mushrooming of the femoral head and shortening of the femoral neck. The deformity was not thought to be a primary local one but a secondary static effect due to a relatively increased load borne by the diseased bone. Milch and Pomeranz[26] in 1 of their cases show distinct involvement of both capital femoral epiphyses as well as several other bones in the body. They point out that the condition is often mistaken for acute osteomyelitis or tuberculosis of the hip joint by the clinician.

Kirklin and Hefke,[21] reviewing the literature on osseous Gaucher's disease, found 13 cases, including 1 of their own, which showed changes in the femoral head or pelvis. Most of their cases were thought to be analogous to tuberculosis of the hip. Reiss and Kato[36] are the first (1932) to state definitely that the end picture of Legg-Perthes' syndrome may be simulated by Gaucher's disease. In the same year, Determann[11] also described a case in which the changes in the left hip joint suggested a residuum of Perthes' disease rather than of Gaucher's disease. Melamed and Chester[25] present a case which is probably the most severely involved skeletal Gaucher's disease reported. The principal involvement is in the vertebral column, but close examination of the left femoral head reveals some changes which are very suggestive of Legg-Perthes' disease. Perlman[29] describes a case in which the roentgenologist first thought that the irregular mottled density seen in the right femur was due to a long standing osteomyelitis. There is also, however, apparent shortening and widening of the neck of the femur and a marked coxa vara. These findings, if the clinical history of Gaucher's disease could be disregarded, could very easily fit the criteria for a diagnosis of Legg-Perthes' disease.

From the review of the literature and our

own observation, it seems apparent that so-called Legg-Perthes' disease may occur as either a symptomatic or an idiopathic type. When the roentgenographic examination reveals this condition, a thorough search for the etiologic mechanism should always be made. Whether such diverse causative factors as discussed above have some common denominator leading to the same end result is unknown but seems quite plausible. The final answer must come from pathological studies. Unfortunately, such material is relatively rare and the interpretation and synthesis difficult. And yet, until such an intensive histopathologic study is performed, one can only postulate that perhaps some such common factor does apply for this great variety of pathogenic mechanisms acting at the same site. It is the purpose of this paper to emphasize the concept of the symptomatic type of Legg-Perthes' disease, and to demonstrate that in addition to the already suggested causative factors, Gaucher's disease should also be taken into consideration. The number of cases which may fall into the idiopathic group can only be determined by further detailed investigation.

The surgical interventions for supposed acute osteomyelitis performed in our case, and also frequently reported in the literature,[8,10,12,26,35,43] warrant some comment. That the clinical picture of acute osteomyelitis may be simulated by Gaucher's disease should be stressed in order to prevent unnecessary operations.[13,26,33,40] Careful clinical and roentgenological studies will further serve to eliminate this hazard.

SUMMARY

1. A case of proved Gaucher's disease exhibiting the roentgenographic features of Legg-Perthes' disease is presented.

2. A review of the literature demonstrates that so-called Legg-Perthes' disease is often not a distinct disease entity. It may occur as either a symptomatic or an idiopathic manifestation. Such diverse factors as trauma, infection, endocrine dysfunction, vascular accidents, and so forth, have to be considered as etiologic agents. Demonstration of the features of Legg-Perthes' disease should lead to an attempt to uncover the underlying etiology. Only further detailed investigation will disclose the actual number of cases falling into the idiopathic group.

3. Gaucher's disease should be added as a possible causative mechanism. The simultaneous occurrence of Gaucher's disease and Legg-Perthes' syndrome seems to be sufficiently frequent to exclude a coincidental relationship.*

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* A normal 5 pound, 1 ounce boy was born to the patient on July 31, 1947. When last seen, mother and child were well.

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TRAUMATIC INSTABILITY OF THE ANKLE JOINT

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THE term traumatic instability of the ankle is suggested to denote the clinical picture resulting from a partial or complete tear of the lateral ligaments of the ankle joint. During the past years several excellent articles have been written concerning diagnosis and treatment of injuries to the lateral ligaments of the ankle joint. However, in my experience it is found that this condition is still not readily recognized.

The primary purpose of this paper is to strongly emphasize the importance of a special roentgen technique to be followed routinely in cases of sprained ankles. Eleven cases have been seen in the past fourteen months. Three were severe enough to warrant surgical repair. Five were diagnosed at the time or shortly after injury and conservative treatment was helpful. Three of the patients, in the mildly chronic group have responded to conservative treatment and are symptom free at the time of this report. These cases were diagnosed by the roentgen technique to be described.

From this experience it is felt that the term "ankle sprain or foot sprain" should be discarded unless special roentgen technique has ruled out a ligamentous tear.

HISTORY

In acute cases, the patient usually described an inversion (supination) injury of greater or lesser degree. The trauma described in some cases could be classified as minor. Therefore, a relatively simple injury does not necessarily exclude the possibility of a ligamentous tear.

In chronic cases, the complaint was of instability of the ankle with pain of varying degrees. The slightest roughness of the ground or an uneven curbstone caused the patient's ankle to turn sharply and suddenly into inversion. From occasional episodes of accidental inversion to extreme disability with constant pain due to traumatic arthritis, there are many stages in which the patient may seek the advise of a physician. In taking the history it is important to inquire whether or not this is the first episode or the most recent of a series of minor traumas.

ANATOMY

The ligaments to be considered in this injury are the ones binding the fibula, astragalus and calcaneus together. However, in severe cases the ligaments between the talus and scaphoid and the calcaneus and cuboid respectively may be involved.

The external ligaments of the ankle consist mainly of fasciculi of the capsule which appear to be distinctly separated into three portions.

1. Anterior fasciculus or ligamentum talofibulare anterius, with almost transverse fibers.

2. The posterior fasciculus or ligamentum talofibulare posterius, the most deeply seated of the three, these fibers are almost horizontal.

3. The middle fasciculus or ligamentum calcaneofibulare which is the longest and strongest of the three.

There are a number of other ligaments; lateral talocalcanean ligament, interosseus talocalcanean ligament, which may be involved in an extensive tear. The bifurcated ligament between calcaneus and scaphoid, calcaneus and cuboid as well as the dorsal talonavicular ligament have to be considered.

FUNCTIONAL ANATOMY AND MECHANISM OF INJURY

Contrary to one observer's findings, the author has noted that in a normal ankle the relationship of the talus to the tibia and fibula in the ankle mortice is absolutely stable. In other words, the upper surface of the talus and the distal surface

of the tibia form a joint space the width of which is equal at all times whether in neutral position, inversion or eversion. There is no lateral or medial tilt of the talus under normal conditions, providing the foot is kept within the normal degree of dorsiflexion. Roentgen studies were made of 25 normal ankles, 15 of which were injected with procaine, in the manner described in this article, and no degree of tilt was detected.

It should be stressed that in cases with only a minimal defect noted in the roentgenogram (minor tilt of the talus) there were disabling symptoms, necessitating in 2 cases surgical intervention. This observation appears to disagree with the findings of Watson-Jones.

There is, however, an unstable position which the ankle can assume and it is in this position that the injury occurs, that is plantar flexion. The reason is that in this position the talus, which is wedge-shaped, is being controlled only loosely by the malleoli and a slight degree of inversion and eversion is possible. Therefore, it is reasonable to assume that if a roentgenogram is taken in inversion and plantar flexion, a tilt can be produced; however, it seldom exceeds 4 or 5 degrees. And it follows that the female patient who wears high heels, thus maintaining the foot in plantar flexion has frequent inversion and eversion episodes producing serious ligamentous tears.

ROENTGEN TECHNIQUE SUGGESTED AS A ROUTINE

Since the consequences are so disabling every single inversion injury of the ankle should be roentgenographed in the following manner;

(a) A routine anteroposterior, lateral and oblique exposure.

(b) One anteroposterior view with the forefoot held in extreme inversion. This motion is usually restricted by severe pain.

(c) Five to ten cubic centimeters of 2 per cent procaine hydrochloride solution are injected at the site indicated in Figure 2, *A*, *B*, *C*. It is injected into the sinus tarsi which is about $1\frac{1}{4}$ to $1\frac{1}{2}$ inches distal in a horizontal line extending from the lower tip of the fibula. However, when the area is swollen it is not always easy to palpate the lower tip of the fibula but with the aid of the aforementioned landmarks, some of which are palpable and others may be visualized on the roentgenograms, the injecting needle falls easily into the sinus tarsi. Ten minutes later the maximal painless inversion can be obtained, and another view should be taken in this position.

Fig. 1. Represents one of the 25 normal ankles. This patient received a local anesthetic and roentgenograms were taken in the maximal inversion. The film does not show any change in the position of the talus.

In 3 cases of the series, there was only a minimal separation of the mortice with the first view taken in inversion but after the anesthetic there was a definite gap visualized.

TREATMENT

Aside from the diagnostic value, the procaine injection has a definite therapeutic effect. It is well known that procaine injections are widely used in the treatment of ankle sprains. If the roentgenogram is negative, repeated procaine injections will

hasten the patient's recovery. If, on the other hand, there is a separation of the mortice, and the case is an acute one, the method of choice is immobilization in plaster of paris for eight to twelve weeks. In chronic cases, the real instability or recurrent dislocation should be treated by surgery.

(Fig. 3). At the close of the school term on August 25, 1947, the patient was operated upon for repair of the lateral collateral ligament of the right ankle. The pain and instability disappeared. Follow-up in March, 1947, revealed no complaints.

Case II. P.C. A male, jeweler, aged twenty-six, on August 29, 1947, while running, twisted

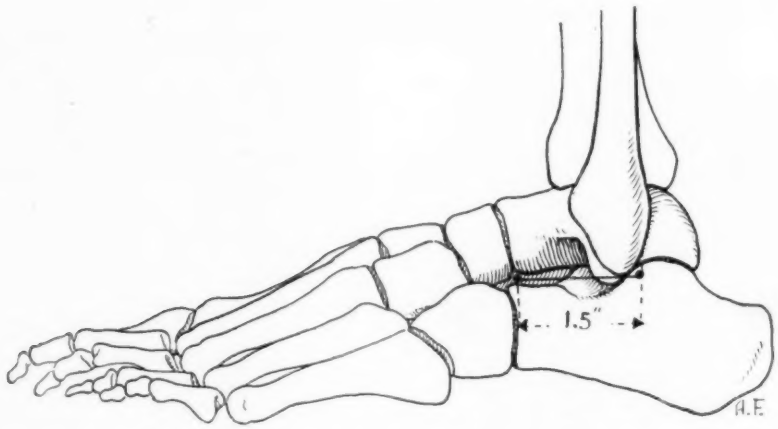

Fig. 2*A*. Sketch showing the bony landmarks of the left ankle, in the lateral position. The location of the sinus tarsi is indicated. The distance from the posteroinferior edge of the fibular malleolus is about 1¼ to 1½ inches. Five to ten cubic centimeters of 2 per cent procaine injected into the sinus tarsi will infiltrate the structure so that sufficient relaxation is obtained to permit extreme inversion.

Fig. 2, *B* and *C*. Photographs indicating the exact site of injection. This applies to chronic or late cases; in the acute stage the site of the hematoma is injected.

CASE REPORTS

Case I. W.S., an athletic director, aged twenty-four, injured his right ankle in November, 1946, while playing soccer. He had negative roentgen reports and was treated for a sprain without definite relief. He was first seen on June 25, 1947, when special roentgenograms revealed an inversion instability of the talus

his right ankle. Roentgenograms were reported negative and he was treated for a sprain. After six months of "lamp" treatments the ankle continued to feel "weak" and to become swollen at intervals. Examination on February 24, 1948, revealed pain with the extremes of motion, especially inversion. Roentgenograms, using special technique, revealed a displacement of the

talus. Operation was performed for repair of the lateral collateral ligament (Fig. 4).

Case III. R.F., aged fifty-one, assistant principal of a high school, stepped off an icy curb, twisting her ankle. Roentgenograms, using special technique taken within a matter of hours, revealed a displacement of the talus without the use of anesthetic. Immediate immobilization for six weeks in plaster of paris boot resulted in complete recovery. Follow-up in

Fig. 3. Case I.

fourteen months revealed no clinical objective or subjective symptoms (Fig. 5).

Case IV. H. G., a housewife, aged forty-five, was seen at the New York Polyclinic Hospital. She gave the usual story of numerous episodes of painful inversion of the ankle without definite accident, but attributed by the patient to "weakness." The duration of these complaints was fourteen months. Figure 6*A*, taken without anesthetic, shows a suggestion of a tilt; however, Figure 6*B*, using the technique described, shows an extensive tilt.

DISCUSSION

Changes in the ankle mortice, following one or more inversion injuries, do not have to be very extensive in order to cause severe disabilities. The diagnosis of "ankle sprain"

Fig. 4, *A* and *B*. Case II.

in the minds of many observers is a very abused term. However, it is the indiscriminate treatment of injuries in this group that appears to be responsible for the subsequent incapacitating changes that take place. If a routine roentgen technique, as suggested, is applied, this injury can be diagnosed immediately and efficiently. And it follows without a doubt that early adequate treatment consisting of prolonged immobilization in a plaster of paris boot will result in

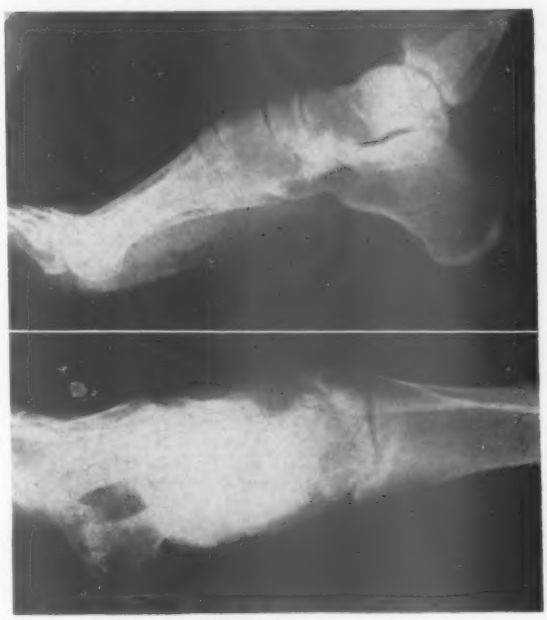

Fig. 5. Case III.

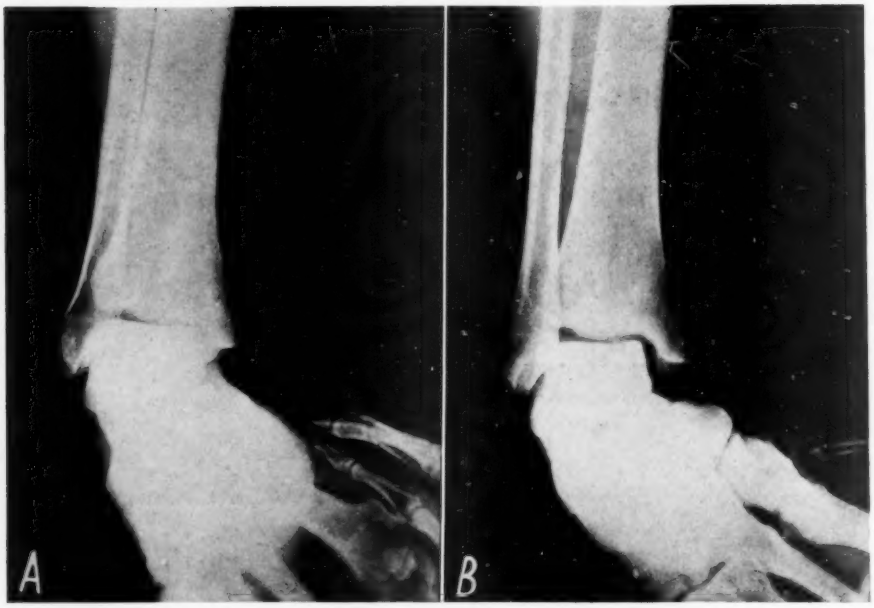

Fig. 6, *A* and *B*. Case iv.

Fig. 7. An acute injury with negative roentgen reports. This illustration is a simple inversion view without anesthetic, which shows sufficient injury to warrant the roentgen diagnosis of torn ligament with subluxation of the astragalus.

Fig. 8. An acute injury with the usual negative roentgen report. Inversion view following administration of anesthetic revealed the pathology.

Fig. 9. A borderline case. There are minimal changes seen in extreme inversion following local anesthetic. Patient had complaints of chronic instability. The roentgenogram also shows the correct way to hold the foot for this exposure *

Fig. 10. This patient "sprained" her ankle eighteen months prior to this roentgen examination. She has been under treatment for that period and never had a roentgenogram taken.

a complete recovery in practically all cases. If the acute stage is not recognized the importance of this roentgen technique in diagnosing the chronic condition is very evident. Operative treatment as suggested by Watson-Jones and the various modifications of this procedure offer very satisfactory results.

CONCLUSIONS

1. Minimal changes about the ligamentous structures of the ankle joint, medial as well as lateral, cause disabling complaints.

2. The diagnosis of sprain is too readily applied to injuries of the ankle.

3. Roentgenograms with the technique described simplify the method of making a diagnosis of a tear of the lateral collateral ligament of the ankle joint.

4. Early and accurate diagnosis of minimal as well as extensive changes in the ligamentous structures of the ankle joint insures the possibility of a good end result.

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* The technician's hand is shown here without protection in order to better illustrate the position in which the foot should be held.

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KIDNEY STUDIES DURING CHOLECYSTOGRAPHY WITH PRIODAX*

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THE use of the organic compound, priodax, for oral cholecystography has become widespread in roentgenology. Numerous clinical reports have attested to its reliability.[1,2,4,6,7] According to these investigators, one of its recommendations is the fact that it is largely excreted through the kidneys, so that confusing shadows of dye in the colon no longer interfere with roentgen interpretation. Although Rigler and Mixer[8] have demonstrated that diodrast injected through a T tube during cholangiography may pass through the liver and be seen in the kidneys, there seem to be only two references in the English literature to the possibility of obtaining accessory information concerning the kidneys during a routine gallbladder examination. Hefke[5] mentions the fact that a priodax cholecystogram of one of his patients demonstrated a hydronephrosis which had not been suspected clinically, and the same observation has been made by Sosman.[9] Because of a similar experience in our clinic (Fig. 1), we began to look for shadows of the dye in renal structures in every cholecystogram in which priodax was used, and it soon became apparent that such shadows were visible in a surprising number of instances (Fig. 2).

While it is known that all of the dye is eliminated through the kidneys within forty-eight hours, the rate of clearance has not been hitherto determined. To this end several patients were examined at frequent intervals for twenty-four hours following oral administration of priodax, and an attempt was made to increase the density of the dye in the renal pelvis and calices by means of restricting fluids to the patient and compression of the lower abdomen for a suitable time before each roentgen exposure. At no time during this study was the dye in the kidney sufficiently increased in density to indicate that there was any significant interval after ingestion when maximum excretion might be expected.

FIG. 1. Cholecystogram after priodax (double dose method) of a patient complaining of indigestion and right upper quadrant pain. Nothing abnormal seen in the gallbladder. Note, however, the faint shadows of the dye in the drainage system of the right kidney. These structures are greatly dilated. A diagnosis of hydronephrosis was made on this evidence and later confirmed by urography.

However, as a result of this experience, it is suggested that two changes be made in the technique commonly employed for cholecystography. Patients should be instructed to refrain from taking any fluids

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FIG. 2. From a roentgenogram made sixteen hours after the oral administration of priodax (double dose method). The dye is seen faintly outlining the normal pelvis and calices of the left kidney.

for ten hours preceding the roentgen examination, and at least one roentgenogram of the upper abdomen should be made on a 14 by 17 inch film with the patient supine and preceded by compression applied to the lower abdomen and pelvis for ten minutes. It is well known that renal disease frequently masquerades behind gastrointestinal symptoms. Indeed, patients have even presented well developed jaundice as the first symptom of an acute right pyonephrosis, and the jaundice has subsided promptly after catheter drainage of the renal pelvis.[3] In many individuals the common bile duct and right renal pelvis are in juxtaposition so that inflammatory disease in one organ produces changes or obstruction in the other. By slight variation in the technique of cholecystography, important information about the kidneys may be gained, and the roentgenologist will be fulfilling his function of obtaining the maximum amount of information concerning the patient from the examination at hand.

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HETEROTOPIC OSSIFICATION IN AN AREA OF METASTASIS FROM RECTAL CARCINOMA

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DEVELOPMENT of new bone in soft tissue neoplasms has been reported infrequently.[1,2,3,4,5] Dukes [6] in 1939 described 4 cases of rectal carcinoma exhibiting this process. Our review of the literature since that time has not uncovered any other instances of heterotopic ossification in non-osseous neoplasms. The case to be reported is unusual in that bone was discovered in an area of regional metastasis from rectal carcinoma.

CASE REPORT

A white male, aged fifty-five, was admitted to the hospital on June 3, 1945, complaining of weight loss and bloody diarrhea of several months' duration. A large, hard, irregular mass was palpable in the rectal ampulla. Physical examination was otherwise negative and routine laboratory work was non-revealing. A one-stage abdominal-perineal resection was performed and aside from some minor postoperative urinary difficulty the patient made an uneventful recovery. No metastases were noted at operation. Microscopically the tumor showed anaplastic epithelial cells forming atypical glands invading deep into the muscle layers. The cells in general had basal nuclei and a moderate amount of cytoplasm. The nuclei varied, some being large, round and vesicular, others being small, deeply staining and oval. Mitoses were frequent. There were areas of necrosis and mucus formation. Infiltration of numerous polymorphonuclear leukocytes and mononuclear cells occurred diffusely.

In February, 1946, the patient complained of pain in the coccygeal region. Roentgenograms at this time revealed only an advanced degree of osteoarthritis of the lower lumbar spine (Fig. 1). The pain became progressively worse and in July, 1946, began radiating down the right thigh and leg. The roentgenogram then showed an irregular moth-eaten appearance of the body of the fourth lumbar vertebra. There was also noted a lobulated shadow of increased density, measuring about 6 by 2 cm., in the right half of the pelvis, adjacent to but not associated with the spine of the ischium (Fig. 2).

FIG. 1. Roentgenogram, February, 1946, showing only osteoarthritis of lumbar spine. No abnormal shadows of increased density.

FIG. 2. Roentgenogram, July, 1946, showing lobulated shadow of increased density in right half of pelvis. Stereoscopically this lies in the region of the spine of the ischium but is not attached.

FIG. 3. Roentgenogram, September, 1946, showing that the radiopaque shadow in right half of pelvis has increased in size. Several small irregular areas of calcification are now present in the left half of the pelvis. The body of the fourth lumbar is increased in density, due to osteoplastic metastases.

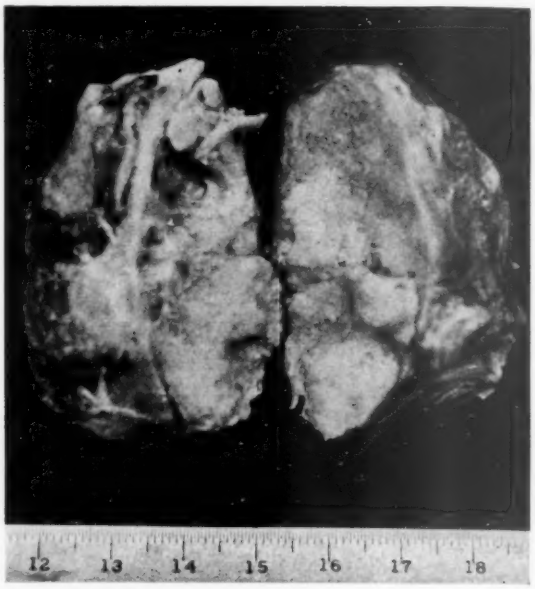

FIG. 4. Gross appearance of retroperitoneal bony mass.

Because of the intractable pain, the sacrococcygeal area was explored but no gross carcinoma was found. The coccyx was removed, and on microscopic examination showed areas of necrosis, but no carcinoma. The patient was relieved of his pain and made an uneventful recovery.

A few weeks later the pain in the sacral region recurred and became progressively worse. Numbness developed in the right lower extremity and walking became difficult. In September, roentgen therapy was instituted, but gave no relief. The patient lost weight rapidly and in early October lost voluntary control of urination. Roentgenograms at this time revealed that the lobulated area of increased density had become larger and was more clearly demarcated (Fig. 3). A few small areas of irregular calcification were noted in the left half of the pelvis in the region of the medial border of the acetabulum. The body of the fourth lumbar vertebra showed slight collapse, with increase in density and areas of bone destruction. The body of the third lumbar was similarly involved by the metastatic process, but to a lesser degree. From this time on the patient's condition became rapidly retrogressive and he died on November 11, 1946.

Autopsy Report. Gross examination: The pelvic peritoneum was covered with hard white nodules, ranging from 1 to 3 cm. in diameter. To the left of the bladder was a hard growth that involved the serosal surface of bladder and invaded the prostate. Retroperitoneally a stony-hard, spherical mass (Fig. 4) easily stripped away from the right ischium, immediately above the obturator foramen, leaving an intact periosteal surface. The mass measured 3 by 5 by 6 cm., was white in color, and had a lobulated surface. It was surrounded by a dense connective tissue capsule and when sawed in two presented a white, bony surface, that was divided by several trabeculae.

Metastatic nodules of carcinoma were found on the endocardium of the right auricle, in the liver, lungs, and in the second, third and fourth lumbar vertebrae. Several dozen small faceted stones were present in the gallbladder. The left kidney pelvis contained many soft yellow stones measuring from 0.2 to 0.3 cm. in diameter. Scattered throughout the parenchyma of both kidneys were many soft abscesses measuring from 0.3 to 0.5 cm. in diameter.

Microscopic examination: Sections of the metastatic growths in the liver, lungs, right auricle, prostate and vertebrae showed invading anaplastic epithelial cells, forming atypical glands separated by thin strands of connective tissue. The cells were of columnar type, with small to medium sized nuclei; some of the latter were deeply staining, while others were vesicular. The cytoplasm was abundant and some-

what basophilic. Mitoses occurred in moderate numbers. Large areas of necrosis were present. The growth that invaded the prostate showed areas of mucoid degeneration similar to the original rectal growth.

The retroperitoneal hard mass consisted for the most part of trabeculae of old bone, showing in a few areas small foci of blue granular amorphous material (Fig. 5). Elsewhere there was abundant young connective tissue containing osteoid tissue (Fig. 6). Scattered throughout the mass were atypical glands, some of which formed mucus. There were no leukocytes and few vessels.

Fig. 5. Decalcified section of mass showing trabeculae of old bone, atypical glands, and mucus.

Section of the kidneys showed bilateral acute pyelonephritis. In none of the organs was there any metastatic calcification.

COMMENT

This case presents an adenocarcinoma of the rectum, which was removed by abdominal-perineal resection. A year after the operation an area of radiopacity was seen in the right pelvis. This opacity had not been present on previous roentgenograms. It progressively enlarged and at autopsy was found to be a spherical, bony mass in the region of the right obturator node. The mass though adjacent to the periosteum of the ischium was not intimately connected with it. It was scooped out with very little effort.

There are two possibilities as to the nature of the bony mass. The first is that there was a pre-existing exostosis to which carcinoma had metastasized. The second possibility is that the carcinoma metastasized to the soft tissue in the region of the obturator node and bone then formed in the metastasis. The latter explanation appears more logical to us. In the former case it would be necessary to postulate that if there were an exostosis, it would have had to separate spontaneously from the ischium, as there was no evidence of any osseous connection between the two. Moreover, one of the earlier roentgenograms would have shown the presence of a bone tumor. It is impossible to rule out the existence of a benign connective tissue tumor, which had been invaded and completely replaced by bone.

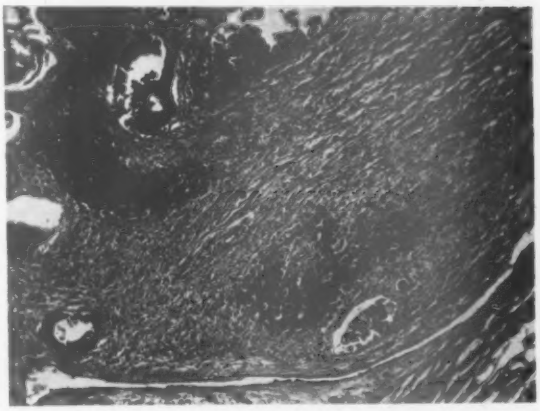

Fig. 6. Section of mass showing young connective tissue, osteoid tissue, and atypical glands.

The subject of heterotopic bone formation has been widely studied and a number of theories have been postulated.[3,7] Huggins[8] stimulated much interest in the problem by inducing bone formation in certain connective tissues of dogs and rabbits with transplants of urinary tract epithelium. The explanation of this phenomenon remains incompletely answered, although the theories of Leriche and Policard[7] seem to offer the best explanation as yet presented. They believed that heterotopic bone originates by metaplasia of connective tissue, the two necessary factors being: (1) a young connective tissue medium, and (2) a calcified deposit in the immediate vicinity

of the connective tissue. The calcified deposit, according to them, can be adjacent bone, or necrotic tissue which has become infiltrated with calcium salts.

In our case the metastatic areas contained abundant young connective tissue stroma, and small areas of necrosis and mucoid degeneration. Some of these areas were infiltrated with calcium. The ossified tumor was, moreover, immediately adjacent to (but not directly connected with) the right ischium. Thus, both prerequisites of Leriche and Policard were fulfilled.

The common features noted by Dukes[6] in his 4 cases of ossification in rectal cancer were: (1) long duration of symptoms, indicating slow growth; (2) histopathologic picture of growth of low grade malignancy, with no tendency to spread by veins or lymphatics; (3) presence of necrosis within the tumor. Our case showed necrosis in the tumor, but otherwise differed from the above in that it progressed rather rapidly and metastasized widely.

The problem of the failure of new bone to form more frequently in tumors deserves consideration. Certainly one would think that the coincidental presence of young connective tissue and of a calcium source occurs frequently enough. Two conclusions may be drawn from this, we believe: (1) that other factors besides the two mentioned previously are necessary for bone formation; (2) that small foci of ossification do occur more frequently, but remain undiscovered or at least unreported.

SUMMARY

A case is presented of heterotopic bone formation in an area of regional metastasis from carcinoma of the rectum and the explanation of this phenomenon is suggested.

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IRRADIATION IN CANCER OF THE TONGUE*

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INTRODUCTION

CANCER of the tongue is known to be the commonest malignant lesion of the oral cavity, making up 21 per cent[21] of all oral lesions. Many such growths go unnoticed for months, often being attributed by the patient to gastric upset with accompanying "canker sore." Cancer may start as a small, indurated, painless, nontender ulcer which becomes raised and granular as it increases in size. Pain occurs as a late symptom, a fact which often accounts for the indifference of the patient. The anterior two-thirds of the tongue is the most common site of the disease. With lesions at the base of the tongue, metastatic nodes frequently appear before the patient develops pain, hoarseness, dysphagia or dyspnea.

DIAGNOSIS AND DIFFERENTIATION

Examination of the tongue by visualization and palpation is easy, yet biopsy is the only method of verifying the diagnosis. In appearance, cancer of the tongue may vary from a hard-edged ulcer to a warty growth or indurated plaque. Occasionally no ulcer is visible but marked induration can be palpated.

Complete history and careful examination are important to determine the duration and extent of the carcinoma and the presence or absence of palpable nodes. After confirmation by biopsy, treatment should be instituted immediately for within a matter of days, the rich lymphatic drainage of the tongue[3] may change the character of the case from operable to inoperable with the development of lymph nodes.[24]

White patches on the mucous membrane, or leukoplakia, is a frequent forerunner of malignancy and may appear at any time, often persisting after the primary lesion has healed. It often accompanies luetic glossitis, vitamin deficiencies or it may be the result of irritants such as bad teeth, ill-fitting dentures or excessive smoking.

The percentage of syphilis in cases of cancer of the tongue is high. Levin[1] reported five times greater evidence of syphilis associated with cancer of the tongue than with any other form of cancer. Ackerman and del Regato[1] state that the incidence of syphilis in cancer of the tongue is 20 to 40 per cent, while Sharp and Spickerman[23] found only 13 per cent in their series. It has been suggested that the arsenic used in antisyphilitic treatment may be a predisposing factor in cancer of the tongue. This theory seems practical only when other signs of arsenical poisoning are present, such as skin changes on the hands and feet.

Two lesions are often construed as carcinoma. One is glossitis rhombica mediana which was first described by Borcq and Pautrier in 1914.[25] It is a benign condition with clinical symptoms of indurated, nonulcerated, painless, superficial ovoid or rhomboid mass which is situated just anterior to the apex of the V-shaped circumvallate papillae. The surface is smooth, shiny and red but at times several yellowish tinged papules are present.[15]

The other lesion that is not unlike carcinoma of the tongue is the granular cell myoblastoma. It is a smooth, firm mass covered by the epithelium of the tongue and characteristically the epithelium thins out only over the dome and undergoes changes indistinguishable microscopically from carcinoma.[7] For this reason a deep biopsy must be done for a correct diagnosis. Surgical excision is the treatment but it need not be as radical as for malignancy. These lesions are not affected by irradiation. They are benign in the majority of cases. An exceptional granular cell

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myoblastoma will metastasize and behave like a malignant tumor.

PATHOLOGY

Carcinomas of the anterior two-thirds of the tongue are usually well differentiated squamous cell epitheliomas. They metastasize to the regional lymph nodes and occasionally distant secondary metastases are noted. Lesions arising in areas of leukoplakia are, in many instances, multicentric. However, the degree of malignancy is low with less tendency to involve contiguous tissue and the lymph nodes.

The base of the tongue gives rise to squamous cell carcinoma, lympho-epithelioma and lymphosarcoma. They metastasize to the regional lymph nodes as well as to distant areas.

Previously the figure for distant metastases that could be appreciated clinically was 2 per cent.[22] Sachs[22] reports 9.7 per cent with distant metastases on the basis of autopsy findings and 5.4 per cent on the basis of clinical findings. Lenz and Sproul[12] state that generalized secondary metastases are rare except in the transitional cell carcinomas. This type is now considered squamous cell epithelioma of a lesser degree of differentiation without keratinization.

In the past it was believed that the degree of histological differentiation of the tumor had a marked effect on the end results of treatment. In view of the varied responses, however, it is now felt that this is no longer true.[18] It is our impression that the rare anaplastic lesion of the anterior two-thirds of the tongue is less amenable to surgery or to radium needles and it is best treated by intensive roentgen therapy which includes the lymph bearing areas. In these lesions disease is usually well beyond the limits that can be appreciated clinically.

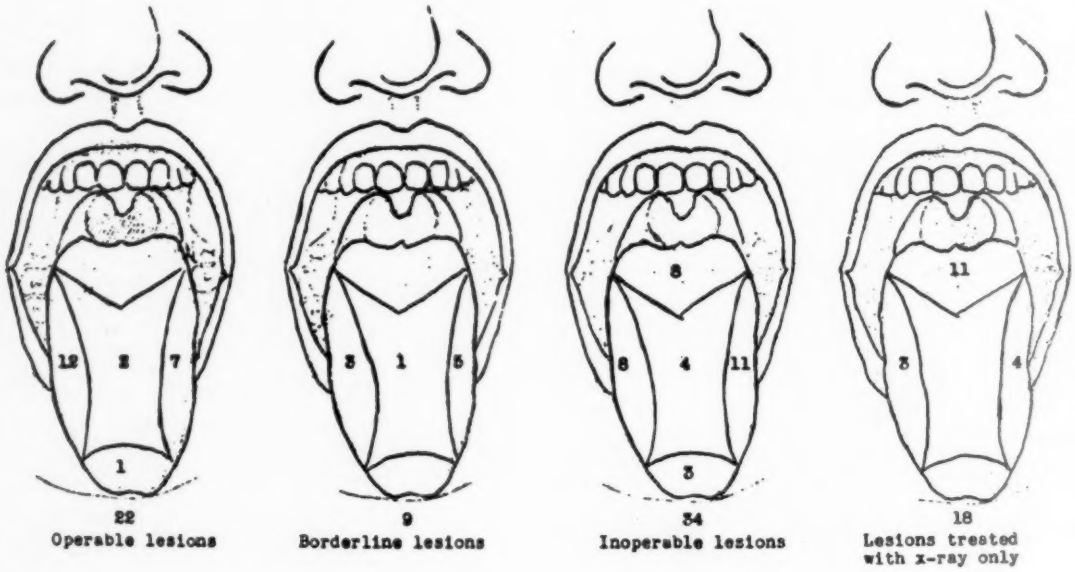

Fig. 1. Location of tongue lesions.

CLASSIFICATION

For the purpose of classifying the sites of the primary lesions, Morrow's[18] suggestion has been used. Of the 167 cases reviewed by him, 56 lesions occurred on the left border of the tongue and 44 on the right border. On the mid-dorsum of the tongue there were 20 lesions while 3 arose on the tip and 42 on the base of the tongue.

The accompanying diagrams (Fig. 1) illustrate the location of the lesions in this study divided as to their operability.

In some clinics, surgery is the treatment of choice for primary lesions of the tongue while in others, irradiation is preferred. In 1940 Martin *et al.*[16] analyzed 556 cases of cancer of the tongue dividing the cases into operable, borderline, and inoperable groups. They favored irradiation at that time and the above terms indicate the classifications which are useful to both methods.

The operable cases had small lesions which might have been excised with a 1.5 cm. margin of normal tissue to insure removal of any extension not grossly evident. There were no palpable nodes, or if nodes were palpable, they were small and unilateral on the same side as the lesion. The general condition of the patients was good, making up the last essential for surgically favorable cases.

The inoperable cases included the advanced or recurrent lesions as well as cases involving the base or posterior one-third of the tongue and those invading the floor of the mouth and anterior fauces. Into this group, too, fell all cases with involved cervical nodes on the side opposite to the lesion, bilateral nodes or inoperable nodes on the same side as the lesion and lastly, all patients with poor general condition. We added to this group all lesions which started on the border of the tongue and extended across the midline.

The borderline cases were those which fell into no definitive group but were usually considered inoperable.

The merits of this classification are that it is applicable to both irradiation and surgery in establishing definite criteria for treatment as well as in simplifying and clarifying analyses.

TREATMENT OF TONGUE LESIONS

Radiation for the treatment of cancer of the tongue is preferred for several reasons, the most important being, from the patient's point of view, that no impairment of speech occurs. From the medical standpoint, the mortality of the technical procedure is almost nil. Finally, although it is difficult to evaluate accurately because of the conflicting reports in the literature, it is generally believed that the five year survival rate is higher.[10,19]

Radium needles interstitially are used in most cases involving the anterior two-thirds of the tongue. Occasionally external roentgen therapy is given first to reduce the infection and possibly the size of the lesion. However, because intensive irradiation devitalizes the tissues, dental extractions after treatment may result in necrosis of the bone. For this reason all carious teeth are removed first. If the dental work is extensive enough to delay treatment, only the teeth on the side of the lesion are extracted and five to ten days following this radium is implanted. If the mouth is clean and edentulous, the course will be smooth. Since the teeth cannot be properly cleaned during the period of irradiation, bacteria lurking at the base of the remaining teeth may give rise to infection. To prevent this eventuality, the patient is started on chemotherapy twenty-four hours before the insertion of radium. By continuing chemotherapy throughout the full treatment time, the discomfort from superimposed infection has been completely eliminated. As with any operative procedure, a good night's rest is insured by adequate sedation. Breakfast is withheld and morphine is given one-half hour before anesthesia which is obtained by a bilateral mandibular block including the lingual nerve.

The radium needles generally used are 3.2 cm. long with an active length of 2 cm., containing 1.98 mg. of radium filtered through 0.5 mm. of platinum. Each end of the needle has an inactive portion of about 0.5 cm. The sharp bevelled point permits easy penetration of tissue. The opposite end has two eyes which are threaded. The eye nearest the shaft contains a fine black silk suture on which a small curved cutting edge needle is threaded. The distal eye has a special serum proof silk sufficiently long to attach to the cheek after the radium has been inserted.

The tongue is gently held by an assistant and extended without the use of clamps or

sutures. The sites of insertion are decided upon before any needles are implanted so that only one puncture is made. In selecting the sites, the distance from the mandible is carefully considered. The needles are placed at least 0.5 cm. from the lateral margin of the tongue to prevent over-irradiation of the bone which might lead to osteomyelitis. The ideal distribution of the needles is obtained when they are placed 1 cm. apart. This prevents necrosis of the tongue and also delivers a more uniform dosage. Each radium needle is sewed to the tongue with one black silk suture which is tied loosely. Moderate edema tightens the tissue around the sutures so that the needles are held firmly without damage to the tongue and only rarely does a needle come out. Radium applied in this way is no more traumatizing than the insertion of radon seeds. The entire procedure including the nerve block requires little more than thirty minutes. A diagram of the tongue with the radium needles in place is shown in Figure 6.

The radium needles remain in place until a calculated dose of 8,000 gamma roentgens or more is given, usually five to seven days, at which time they are removed easily by cutting the silk suture and by applying gentle traction on the radium thread. At the time of removal, bleeding is minimal and can be controlled by gentle pressure.

The accompanying reproduced roentgenogram (Fig. 7) shows the radium needles in place. The one horizontal needle was inserted in the floor of the mouth because the lesion extended almost to the gingival gutter.

During the period of application, the patient is kept comfortable with analgesics. Fluid balance is maintained usually by oral administration but the occasional recalcitrant patient is given intravenous solutions. Most patients can take a semi-solid diet but citrous fruit juices are to be avoided because of discomfort to the patient. Mouth irrigations are given every three hours for comfort and cleanliness but in spite of this measure, the tongue becomes coated, furred and foul. When this complication becomes severe, glycerine applied gently with a soft cotton swab is helpful. There is great individual variation in the amount of local pain present and if severe, it can be controlled by cocaine spray. The patient is hospitalized for the radium application but is not confined to bed.

Since the radiation reaction is not expected for a week or ten days following the treatment, the patient is usually discharged the day following removal of the radium and thereafter is followed in the outpatient. department. The reaction is characterized by a severe glossitis, a painful burning sensation and the formation of a white membrane uniformly covering the irradiated area. Because the inactive portions of the needles are nearest the palate, only a slight reaction develops here. The peak of the reaction is attained about three weeks following treatment and then gradual subsidence takes place. During this time the patient is given sedation either mild or moderately heavy as indicated by the severity of the reaction. By the time the tongue is healed sufficiently to tolerate palpation, the ulcer has disappeared and if the response has been favorable, only a mild induration persists.

Three methods may be used for treating inoperable cancer of the tongue. The lesions located on the anterior two-thirds may have interstitial radium although it is not unusual to substitute roentgen therapy by means of an intraoral cone. If the latter method is chosen, an attempt is made to deliver 5,000 r tumor dose, using a cone 3 cm. or 4 cm. in diameter. Treatment of lesions located at the base of the tongue is usually done by external irradiation with an 8 by 10 cm. field to each side or occasionally a 6 by 8 cm. field to each side and one submental field is used. Two fields are treated daily, giving 100 r to 150 r in air to each field until a tumor dose of 5,000 r to 6,000 r is delivered.

TREATMENT OF NODES

The treatment of the nodes in cancer of the tongue remains a controversial subject

and the procedures used have been varied. A prophylactic neck dissection on the side of the lesion may be done or a complete bilateral neck dissection down to the clavicle. Some clinics treat nodes as they appear by the insertion of radon seeds and others use external irradiation. Still others give preoperative roentgen therapy to the neck while the primary lesion is being treated and follow this with a radical neck dissection. Occasionally in rapidly developing lymphatic involvement where the delay necessary to treat the tongue lesion first may result in the nodes becoming inoperable, a neck dissection is done first.

Morrow[18] reported that of 98 cases, 59 had palpable nodes of which 22, or 38 per cent, showed no metastases. However, of 18 cases without palpable nodes, 7, or 39 per cent, showed metastases. He recommends surgical treatment of the tongue and bilateral neck dissection to the clavicle. In cases where unilateral or bilateral node dissection was followed at a later day by a supraclavicular node dissection, a 50 per cent survival rate was obtained.

The mortality rate for surgery since 1930 has been 16.7 per cent. For all cases without nodes, 32.4 per cent survived five years, and 11.5 per cent of cases with nodes survived five years.[18]

Martin *et al.*[16] recommend that the nodes be handled by irradiation as they appear. They base this opinion on a review of 118 cases without nodes in which only 22 per cent developed metastases later. If radical neck dissection had been done on all the cases, 92 useless operations would have been performed. The operative procedure carries a 10 per cent mortality.

Each node is treated through a small portal receiving 4,000 r to 8,000 r externally and this is followed by 5 to 10 threshold erythema doses with radon seeds. Radon seeds alone are used for isolated, outlying nodes or for small nodes recurring after treatment.[16] External irradiation alone is used for anaplastic and very radiosensitive lesions.

Raven[20] states that metastatic nodes occur in 69 per cent before six months and in 27 per cent before two months. Of the 188 cases without nodes treated by Martin,[16] only 22 per cent developed metastases later. In our group of 22 cases without nodes (operable group), 6 prophylactic neck dissections were done on the side of the lesion. Only one showed microscopic evidence of disease.

In this hospital we usually do a prophylactic neck dissection on the affected side six weeks following the insertion of radium in the tongue if the lesion appears controlled and did not cross the midline. This is done whether or not nodes are palpable. The patient must be in good general condition and, on a statistical basis of age, life expectancy should be five years or more. If the nodes are indefinite in outline or fixed to the underlying structures external irradiation up to 3,500 r to 4,000 r in air is given to one 8 by 10 cm. or 10 by 15 cm. field at the rate of 200 r to 250 r daily. Occasionally additional irradiation—1,000 r to 1,500 r in air—is given through small cones to individual nodes.

Early in this series large radium packs were applied externally to the neck for treatment of nodes. This method was discarded some time ago because external roentgen therapy has proved more effective. Occasionally radium needles or radon seeds have been inserted in metastatic nodes. The fibrosis and scarring produced by interstitial radium needles causes excruciating pain in the neck. We feel now that this is unwarranted and prefer external roentgen treatment. This extensive scarring and fibrosis does not follow interstitial radium in the tongue because of the better blood supply.

Considering Morrow's[18] good results with bilateral neck dissection, this procedure may be done more frequently in the future.

MATERIAL

Eighty-three cases of carcinoma of the tongue admitted to the Radiotherapy Department of the Presbyterian Hospital from December 2, 1929 to February 8, 1946 were reviewed. All were proved by biopsy. They were classified according to

the criteria mentioned above and the tumor dose was calculated for each case. The Paterson and Parker charts were used for the determination of the radium dose and the K. S. Cole graph was used for the roentgen-ray dose. All dosages mentioned refer to actual tumor dose. The roentgen-ray factors were 200 kv., 25 ma., 50 cm. target skin distance, with 1 mm. Cu plus 1.25 mm. Al filter. The average daily dose was 200 r to 250 r in air and the duration of treatment was four to six weeks. The size of the fields varied too widely to be listed here.

Radium dosage in gamma r	Pre-radium dosage in x-ray	Survival period: Under 1 year	1 to 2 years	2 to 3 years	3 to 5 years	5 to 10 years
		Case number				
4400r - 5000r			5			
" " +	3000r					17
5400r - 6600r		4	9			7'*
" "			21*			10"*
" "			22'*			13"°
" "						14"*
" "						18
" " +	5580r		15			
" " +	1400r		16			
7000r - 8500r		8		2°		1'
" "		12'°		6		3'°
9000r - 10,000r				20'		11"
" "						19*

'Cases with unilateral neck dissection. °Died of other causes.
"Cases with bilateral neck dissections. Cases 1, 17, 18 lost to follow-up.
*Patients living and well.

Fig. 2. Operable tongue lesions.

Twenty-two cases were classified as operable. The average duration of symptoms was 9.25 months as compared to seven months quoted by Sachs,[22] Martin *et al.*,[16] and four months by Cade.[4] There were 15 white males, 1 negro male and 6 white females which is a ratio of approximately 1 female to 3 males. The average age was 58.4 years. Serology tests were done on 17 patients. Of these 6 were positive for syphilis.

Nine patients were edentulous, 3 had teeth in fair condition and 10 had poor dental hygiene. Smokers and non-smokers were equally divided. The most common site of the lesions is the lateral border. Leukoplakia was present in 6 of the cases.

The table in Figure 2 shows the tumor dose and survival period of the operable lesions with each case designated by number. Ten of 19 patients survived over five years, giving a survival rate of 52.6 per cent. Three patients were admitted after 1942 and therefore could not be included in this percentage rate. Seven of the surviving 10 cases had neck dissections, 4 of which were bilateral. Of these 4, only 1 (Case 11) had histopathological evidence of disease in the nodes.

Nine cases were classified as borderline. The average duration of symptoms was 7.4 months. There were 7 white males, 1 negro male and 1 negro female. The average age for the group was 65.5 years. Only 6 histories recorded the serology; of these, 3 were positive for syphilis. Five patients had poor teeth, 1 was edentulous and 3 had fair dental hygiene. Three patients were heavy smokers, 3 were moderate smokers and 3 histories gave no reference to smoking. Leukoplakia was present in 3 cases. The site of the lesions with the number of cases for each is shown in Figure 1.

Figure 3 shows the tumor doses and survival period of the 9 borderline cases with each case designated by number. None of the cases are represented in the five to ten year column although Case 8 and Case 9 are too recent to have attained that survival period. Both are living and well. On Case 8 a unilateral neck dissection was done five months after treatment of the

tongue lesion. The nodes were positive for cancer histopathologically.

Case 3 had pulmonary and esophageal metastases and Case 5 had metastasis to the femur.

16 used tobacco. Eleven of 34 patients had leukoplakia. Location of the lesions is shown in Figure 1.

A summary of the tumor dose and survival period for each case in this group is

Radium dosage in gamma r	Pre-radium dosage in x-ray	Survival period: Under 1 year	1 to 2 years	2 to 3 years	3 to 5 years	5 to 10 years
			Case number			
5000r - 6000r	+ 7600r		3			
" "	+ 1200r			7		
6000r - 7500r		2	1			
" "		5	6			
" "	+ 3960r		4			
8810r				9'*		
11000r					8*	

'Case with unilateral neck dissection.
*Patients living and well.

Fig. 3. Borderline tongue lesions.

Radium dosage in gamma r	Pre-radium dosage in x-ray	Survival period: Under 1 year	1 to 2 years	2 to 3 years	3 to 5 years	5 to 10 years
			Case number			
3900r - 4600r			5'			
" "	+ 6000r	27	8'			
" "	+ 1500r		16			
4600r - 6000r		9'				
" "		12				
" "	+ 5000r	11				
" "	+ 8500r	10				
6000r - 7500r		7	2"		24*	19*'
" "						20*'
" "	+ 2000r		13'			
" "	+ 4000r				14	
7500r - 9000r+			1	28*		17'
" "			33*	29*'	25'	
" "				34*		
" "	+ 5890r		6			
" "	+ 2500r	23			22°	15°
" "	+ 1000r					18*
" "	+ 2000r	21				
" "	+ 7800r				3"	

'Cases with unilateral neck dissection.
"Cases with bilateral neck dissections.
*Patients living and well.
°Died of other causes.
Cases 4, 26, 30, 31, 32 lost to follow-up.

Fig. 4. Inoperable tongue lesions.

There were 34 inoperable cases in which the average duration of symptoms was 7.5 months, approximately two months lower than for the operable group. Twenty-seven white males, 1 negro male and 6 white females were represented with an average age of 58.4 years. Of 24 histories giving reference to serology, 9 were positive for syphilis. Of 23 dental histories 14 had poor teeth, 2 had fair dental hygiene and 7 were edentulous. Twenty patients were questioned about their smoking habits. Of these

shown in Figure 4. The condition of the nodes was mentioned in 30 histories and of these, 12 patients, or 40 per cent, had palpable nodes on admission. These were thought clinically to be metastatic. Of these 12 patients, only 4 had neck dissections. Two patients (Cases 2 and 3), both of whom had palpable nodes before treatment of the primary lesion, had bilateral neck dissections. The nodes on both sides showed histopathological evidence of carcinoma. Case 2, who had 7,479 gamma roent-

gens to the tongue lesion, died at the end of twenty months of pulmonary metastases. Case 3 was given 7,800 r intraorally plus a tumor dose of 8,900 gamma roentgens to the tongue. Two years later he developed a local recurrence and this was treated with 4,909 gamma roentgens. He died three years and six months after admission with metastases to the eye and with extensive local disease.

Two cases (5 and 8) had unilateral neck dissections before the primary lesion was treated because the tongue lesions could not be diagnosed. In Case 5 the primary lesion was discovered six months after the neck dissection and in Case 8 the tongue lesion was diagnosed two years after the neck dissection. Both lesions were situated at the base of the tongue. Case 5 died of cancer four months after the insertion of radium while Case 8 died two years after radium insertion or four years after the neck dissection.

Five unilateral neck dissections on the affected side were done. Two had palpable nodes on admission. These were positive for cancer histopathologically and both patients died within one year. Of the 3 cases with no palpable nodes, 2 had histopathological evidence of disease in the nodes. Case 19, with histopathological evidence of disease in the nodes, is living and well five years. Case 20 with histopathological evidence of disease in the nodes had had a partial glossectomy one month prior to the radium insertion which was done for the rapid recurrence of the disease. He is living and well six years after radium insertion. The patient with histopathologically negative nodes had involvement of the lip, floor of the mouth and gum. He received 7800 r plus 7,600 gamma roentgens. Four years after admission he had a local recurrence and died of local disease two years after the recurrence.

Four unilateral neck dissections were done on cases admitted within the past three years. Case 25 now has disease in the opposite side of the neck although the lesion did not cross the midline. His neck dissection was delayed until nodes were palpable. Five of 23 patients lived five years or more giving a survival rate of 21.7 per cent. Eleven cases were admitted after 1942 and therefore could not be included in this percentage.

Eighteen patients were treated by roentgen irradiation alone. All were inoperable because of the site of the lesion or extent of the disease except two. Cases 14 and 16 had small lesions but their general condition would not permit the use of interstitial radium. The average duration of symptoms was 5.8 months. There were 13 white males,

X-ray tumor dose	Survival period				
	Under 1 year	1 to 2 years	2 to 3 years	3 to 5 years	5 to 10 years
	Case number				
3260r - 4500r	1		14*		
" "	8				
4500r - 5000r	5	18		10	
" "	6				
" "	15				
5000r - 6000r	11	2		12	4°
" "		17		13	7
6000r - 7000r		16*	9		
7000r - 8000r	3				

*Patients living and well.
°Died of other causes.

Fig. 5. Tongue lesions treated with roentgen irradiation only.

2 negro males, 1 Chinese male and 2 white females. The average age was 62.7 years. Twelve histories recorded the serology of which 4 were positive for syphilis. Sixteen histories recorded the condition of the teeth. Of these, 9 had poor teeth, 2 had fair dental hygiene and 5 were edentulous. Tobacco history of 13 patients showed 4 heavy smokers, 6 moderate smokers and 3 non-smokers. One had leukoplakia. The site of the lesions with the number of cases for each is shown in Figure 1.

The table in Figure 5 shows the tumor dose and survival period with each case designated by number. Eight cases, or

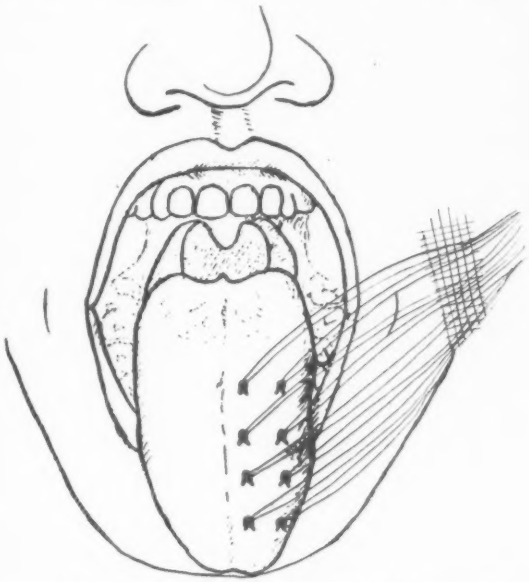

Fig. 6. Diagram of the tongue with radium needles in place.

44.5 per cent, had palpable nodes on admission; 6 had no palpable nodes and in 4 the nodes were not mentioned. No neck dissections were done.

Two of 13 patients, or 16.9 per cent, lived over five years. Six patients were admitted too recently to be included in this percentage group. Case 4 with a lesion at the base of the tongue received a tumor dose of 5,250 r. He died of pneumonia eleven years after treatment with no evidence of disease in the tongue. Case 7 also had a lesion at the base of the tongue which received a tumor dose of 5,400 r. He died of

Fig. 7. Roentgenogram showing radium needles in place.

coronary thrombosis eight years after treatment. The autopsy showed a superficial recurrence in the tongue.

The 2 cases with small lesions on the lateral margin of the tongue, who were poor risks for radium insertion, are living and well two and a half and one and a half years without evidence of disease in the tongue or neck. Case 14, living two and a half years, received 4,400 r tumor dose with an intraoral cone. Case 16, living one and a half years, received 6,600 r.

Two of the 18 cases had pulmonary metastases.

Martin[16] reported a five year survival rate of 57 per cent for the operable group treated by irradiation, surgery, or a combination of both. The inoperable group showed 7 per cent five year survival rate while borderline cases showed 36 per cent. The survival rate for the entire group was 25 per cent but 45 per cent for those who had no metastases at any time.

According to Greenwood, quoted by

Lane-Claypon,[11] 16.4 months is the average natural duration of life without treatment.

CONCLUSION

Eighty-three cases of carcinoma of the tongue were treated from December 2, 1929 to February 8, 1946. Radium needles interstitially in the tongue, interstitial radium needles in the tongue plus roentgen irradiation, and roentgen irradiation alone were the methods of treatment used. Patients treated after 1942 could not be used in estimating the over-all five year survival rate. Therefore, only the patients treated up to 1942 were included. There were 55 patients, 17 of whom survived five years or more, giving an over-all five year survival rate of 30.9 per cent. This compares favorably with the results of other clinics. All but a few received an adequate tumor dose. An attempt is made to give 8,000 gamma roentgens or more to the tongue when interstitial radium needles are used. If the radium dosage is less, supplementary roentgen therapy is given. Lesions that persist after the usual radium dose is given, receive roentgen therapy. When roentgen therapy alone is used, the aim is to give a tumor dose of 5,000 r to 6,000 r.

The longest duration of symptoms was in the operable group. This is ambiguous for one would expect to find longer duration of symptoms in the more advanced cases. There seems to be no explanation for this.

It is apparent that the size and extent of the lesion as well as the location are the most important factors in determining the prognosis regardless of the tumor dose given. However, until more is known about the biological behavior of cancer and the host's susceptibility and immunity, the accepted tumor doses must be given. Patients are given the full course of irradiation initially.

We favor neck dissection because we know that frequently much normal tissue is damaged by external irradiation without eradicating metastatic disease. No convincing argument can be made for neck dissection because of the small number of cases. Neck dissection does salvage the group of patients with histopathological evidence of disease in the nodes without clinical evidence of metastases. Whether the cases salvaged in this way are greater than the operative mortality cannot be stated from these cases. One patient died as a result of postoperative complications, but again the group is too small for any definite statement.

SUMMARY

1. Eighty-three unselected, consecutive patients with cancer of the tongue are reviewed. Fifty cases were admitted up to 1942. The group had an over-all five year survival rate of 30.9 per cent.

2. The type of irradiation used in treating the primary lesion is given in detail and the management of metastases is discussed.

3. The tumor dose to the tongue is given for each patient and tabulated for easy reference.

4. A classification for the grouping of cases is described.

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PRECISION DOSAGE IN INTERSTITIAL IRRADIATION OF CANCER OF THE CERVIX UTERI*

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CONSTANT efforts to improve irradiation technique are required by the fact that in the treatment of cancer of the cervix uteri, in some 85 per cent of the cases, irradiation is the only method available since, according to those who perform hysterectomy by choice, only 10 to 15 per cent of the cases are proper subjects for this operation. Despite the fairly satisfactory results following the various irradiation techniques, there is dissatisfaction with the amount of radiation reaching the parametrium by any procedure. Of the various techniques being tried in attempts to bring the tumor dose nearer to the ideal, we chose for study the interstitial method as one which had given superior clinical results and was worthy of an attempt at improvement. Employing the precision stereoscope to check the positions of the needles and to measure the distances between the various units, we have been able to calculate the number of gamma roentgens reaching any part of the pelvic cavity and to devise a pattern which apparently brings adequate gamma roentgen dosage to the uterus and all parts of the parametrium.

The present status of the therapy of cancer of the cervix is the outgrowth of various phases of activity in the past. Following Freund's devising of an operation for removal of the uterus in 1878, it became apparent that while a satisfactory number of patients suffering from cancer of the corpus were cured, practically none with cancer of the cervix survived very long. Vaginal hysterectomy had a much lower operative mortality but the cancer mortality was the same. The radical operation devised in 1894 by Ries,[11] Clarke,[3] Werder,[15] and Wertheim[16] was followed by a considerable number of cures. Some definite principles of radium therapy were established by Bailey[2] in 1915 and others. In roentgen therapy the development of the Coolidge tube permitted the accurate application of large doses of roentgen rays. With these techniques fairly well established, for several years there was a virtual competition between the operative and radiation treatment of cancer of the cervix ending in the abandonment of the operation by nearly all in favor of radiation therapy. This was well expressed by Shaw[12] in 1937: "After careful observation of these cases over seven years, Professor Dougal and I have come to the definite conclusion that radium offers the best chance of cure as well as being the more humane method of treatment. Therefore, strong advocates though we were of the operation, we have now abandoned it." Very shortly, however, it became apparent that some cancers of the cervix were definitely resistant to irradiation and that even in some 21 per cent of the earliest cases there was involvement of the pelvic lymph nodes. This, together with the improvement in surgical management which has reduced the operative mortality so strikingly, has stimulated some[5] to revive the operation with the hope that its permanent results will be better than those obtained by the old masters. Since, however, such a small proportion of the cases are proper subjects for the operation, even if found to be superior in such cases, irradiation remains the only treatment available to the majority of the cases.

The intracavity method of applying radium combined with external roentgen irradiation has become the more or less standard procedure but unfortunately de-

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livers an inadequate tumor dose to the lateral parametrium. While there is some evidence that the quality of the rays may have a bearing on the effectiveness of irradiation, it is much more apparent that the quantity of radiation is what really determines the result. Expressed in terms of gamma roentgens, it is commonly accepted that 7,000 gamma roentgens or more applied to a cancer cell will destroy it without severely injuring the normal tissues. At 15,000 gamma roentgens all tissues are destroyed and a slough created. The problem is to apply an effective dose to all regions in which the cancer is observed or suspected. Although 15,000 gamma roentgens is easily applied to the center of the uterus, the dose reaching the lateral wall of the pelvis is below the minimum tumor dose in nearly all of the techniques employed, whether intracavity radium plus external roentgen irradiation, vaginal cones or the use of interstitial radium needles.[6]

Efforts to overcome this deficiency have been made by increasing the voltage and more accurate beaming of external roentgen rays, by more precise application of the vaginal cones,[4,13] and by the use of radon seeds introduced into the parametrium, controlled by roentgenograms which reveal the scantily supplied areas into which supplementary seeds are then introduced.[1]

We were attracted to the interstitial technique by the superior clinical results obtained by Pitts and Waterman[9,14] and by the reasonableness of the idea that by direct implantation within the area in which radiation was desired, any amount of radiation could be obtained. Our plan of procedure was to determine accurately, by the precision stereoscope devised for pelvimetry, the location of the various radium units placed in the uterus and parametrium, to measure the distance between them and from these measurements calculate the dose which had been delivered to any point in the pelvis.

The capsules and needles were introduced with certain precautions which will be mentioned later. On the day following operation, a precision stereoroentgenogram was made. The distances between the centers of the various radium elements were measured and a tracing of one of the films made on paper on which the measurements just mentioned were recorded (Fig. 4). The cervical mass was drawn to scale and the volume calculated to include 0.5 cm. of tissue beyond the circle of needles. The Paterson and Parker tables[7,8] are used to estimate the gamma roentgens delivered to the volume of tissue. Corrections are made for the 1 mm. platinum filter in the capsules. The radiation from the parametrial needles are determined on the dosage tables for linear radium sources according to Quimby.[10]

Figure 1 is an example of our initial efforts. The intrauterine tandem contained two 10 milligram tubes, 2.3 cm. long, active length 1.25 cm., 1 mm. platinum filter. In the cervical mass were inserted a stockade of eight needles parallel to the cervical canal, with a radius of 1.5 cm. from the cervical canal, 1 cm. apart, length 3.2 cm., active length 2 cm., containing 1.98 mg. radium, 0.5 mm. platinum filter. One centimeter lateral to this circle of needles and, at their point of entrance separated by a distance of 1 cm., were inserted two needles each 6 cm. long, active length 5 cm., containing 4.8 mg. radium, filter 0.5 mm. platinum. Those were directed in a lateral and upward direction and diverged from each other in the coronal plane. The duration of treatment was 120 hours.

Figure 2 is a diagram made from a tracing of one of the films to indicate the positions of the centers of the parametrial needles. The stockade of needles in the uterus and the intrauterine tandem are not represented in detail. In this pattern the irregular order of arrangement is obvious, and is due to the lack of familiarity with this method and a lack of visualization of the position and axis of the uterus and the shape of the parametrium.

The dose is adequate in the cervical mass which received 10,000 gamma roentgens.

The dose in the paracervical tissues was,

on inspection, so obviously deficient that it was not calculated.

The dose in the parametrium at "W" near the lateral pelvic wall was on the right side 2,140 gamma roentgens and on the left 1,315 gamma roentgens. Between the parametrial needles on the right side there was

parallel to the uterus. Then a new principle was introduced. Two 6 cm. needles 1 cm. apart were inserted as close to the lateral pelvic wall as possible, entering the vaginal wall at the junction of the middle and upper thirds and lying in a position parallel to the pelvic wall. It was this procedure which

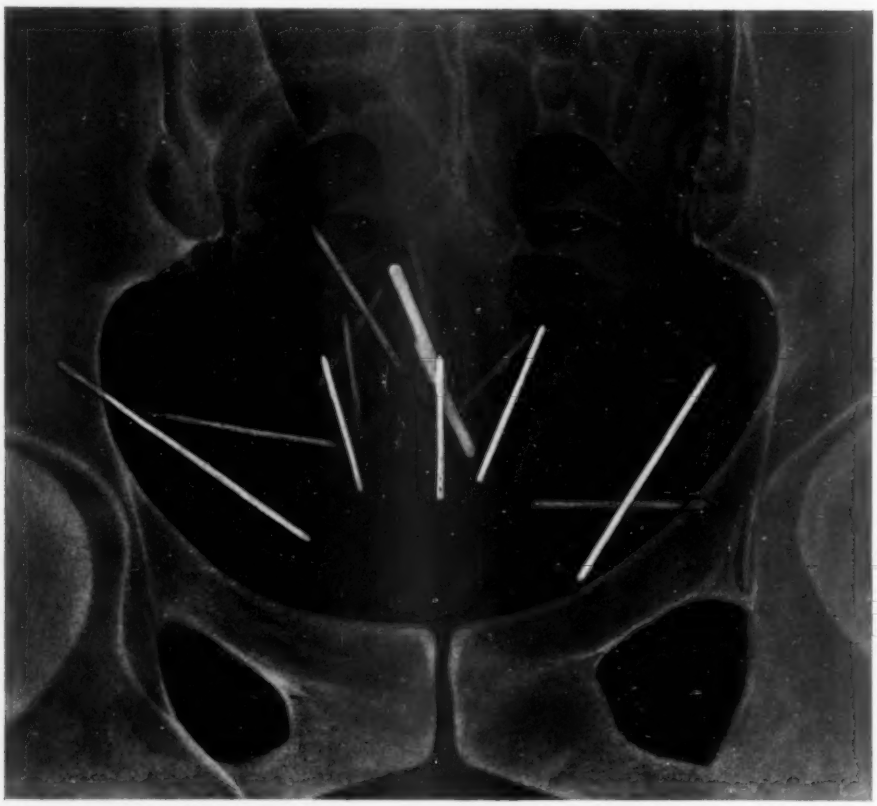

Fig. 1. Case 1. Drawing from roentgenogram showing distribution of radium.

delivered 9,600 gamma roentgens and on the left 6,600 gamma roentgens. The paucity of radiation in the space between needles set wide apart and the sufficiency of the dose between closely placed needles is apparent.

The second case (Fig. 3) illustrates the next step. Three 10 mg. tubes were in the intrauterine tandem. The stockade of eight 3.2 cm. needles with a radius of 1.5 cm. were inserted as in the first case. Then on either side of this stockade, 2.5 cm. distant, was inserted a 6 cm. needle in a direction

led to the devising of a pattern in which all of the needles lay approximately in the sagittal plane. By having the needles more or less parallel, it was possible to add or subtract a unit in order to modify with some accuracy the distribution of radiation.

With the pattern (Fig. 4 and 5) in this second case there was delivered to the cervical mass 14,800 gamma roentgens.

Again the dose in the region lateral to the uterus was deficient, i.e., 1,902 gamma roentgens.

In the lateral parametrium there was de-

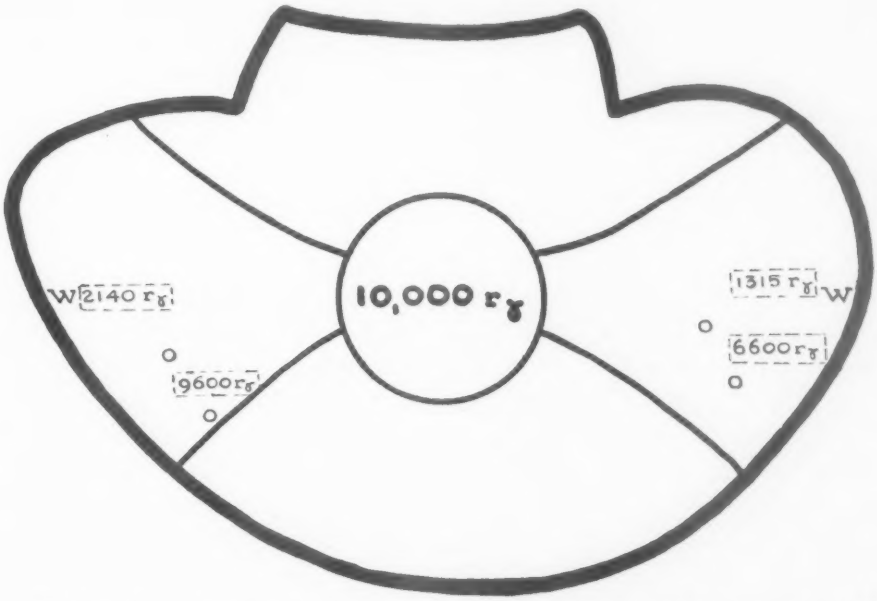

FIG. 2. Case I. Tracing of roentgenogram to show the position of the centers of the parametrial needles and dose in gamma roentgens in the parametrium. The details of the needles in the cervical mass are not shown.

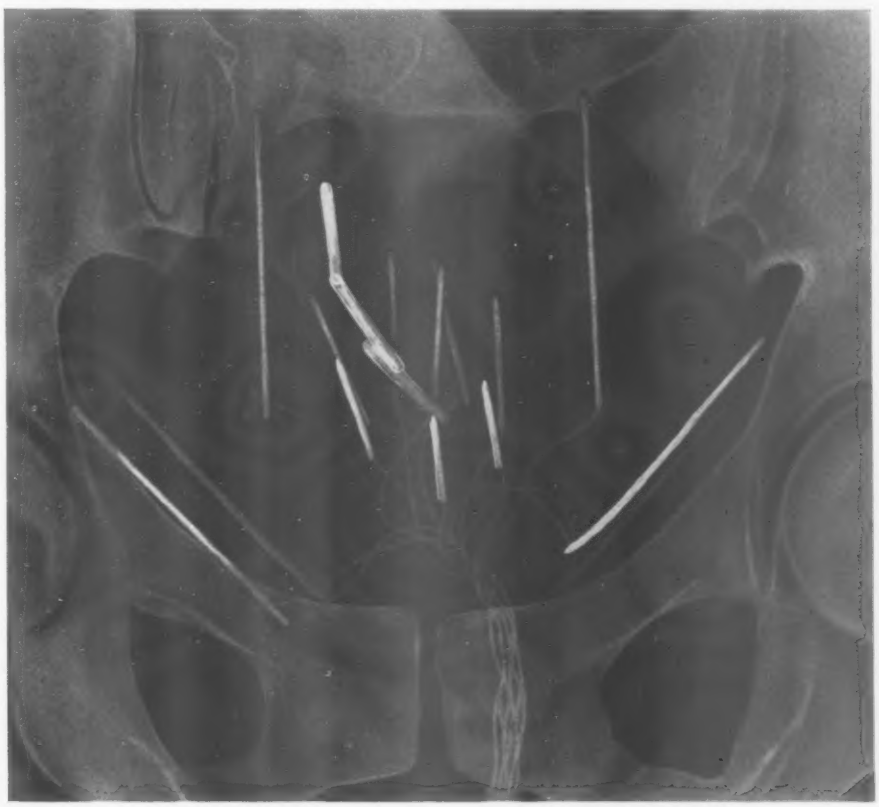

FIG. 3. Case II. Drawing of roentgenogram of pelvis to show distribution of the radium.

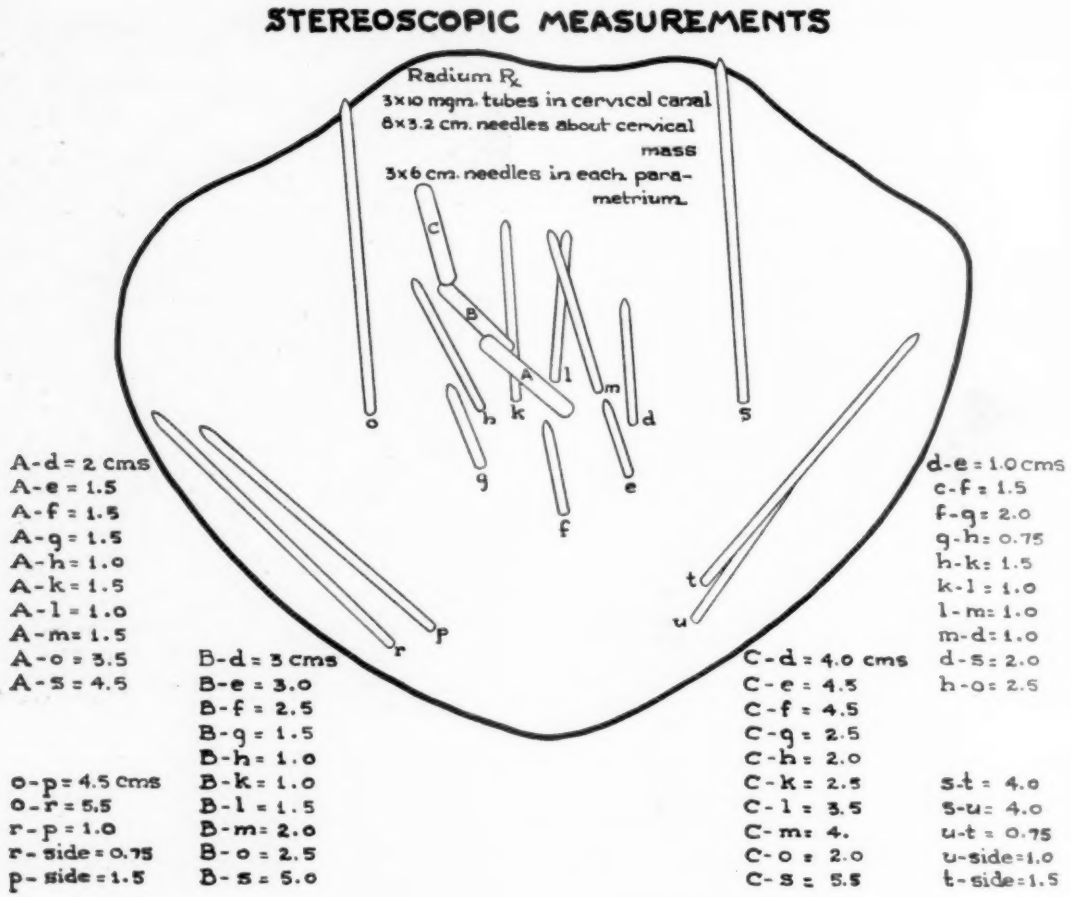

Fig. 4. Case II. Tracing from roentgenogram to show the distances between the centers of the various elements as measured by means of the precision stereoscope.

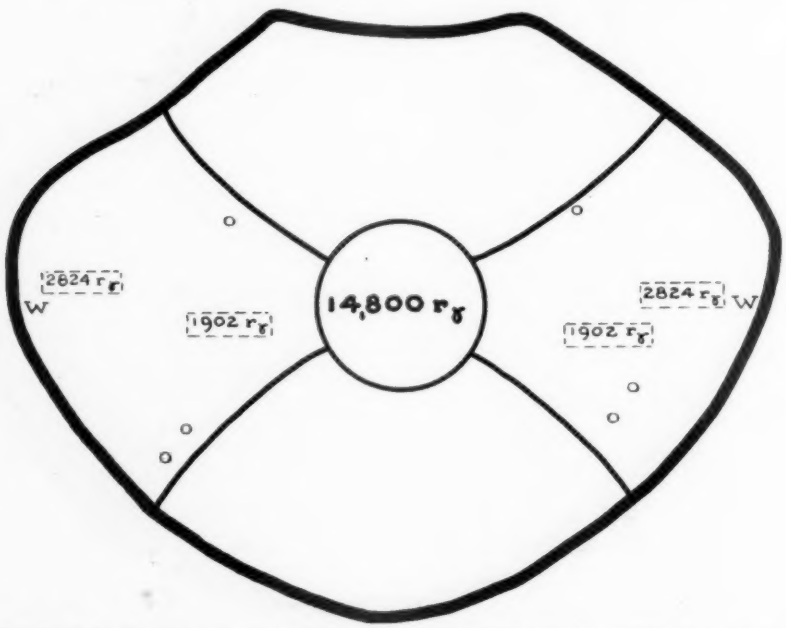

Fig. 5. Case II. Tracing of roentgenogram to show centers of needles and doses in gamma roentgens in different parts of the parametrium. The details of the needles in the cervical mass are not shown.

livered on the right side only 2,824 gamma roentgens and on the left 2,824 gamma roentgens.

Case III (Fig. 6) illustrates the next step. Two 10 mg. tubes were in the intrauterine tandem. The stockade of 3.2 cm. needles had a radius of 2 cm. and were 1.5 cm. to 2.5 cm. apart. This widespread distribution was made because of the enormous volume of the carcinomatous tissue in this particular case. Lateral to this at a distance of 1 cm. and in a direction parallel to the uterine canal, one 3.2 cm. needle was inserted. Lateral to this and parallel to the pelvic wall were inserted three 6 cm. needles 1 cm. apart. On the right side they all lay in a plane parallel to the pelvic wall. On the left side the middle needle lay in a plane about 1 cm. medial to the plane of the other two needles. In this pattern (Fig. 7) the cervical mass received only 9,557 gamma roentgens because of the wide diameter and spacing of the stockade of needles in the cervix.

The parametrial tissues received 5,663.1 gamma roentgens on the right and 5,924 gamma roentgens on the left.

The lateral parametrial tissue at "W" received on the right side 7,000 and on the left 3,009 gamma roentgens. The difference

Fig. 6. Case III. Roentgenogram of pelvis to show distribution of the radium.

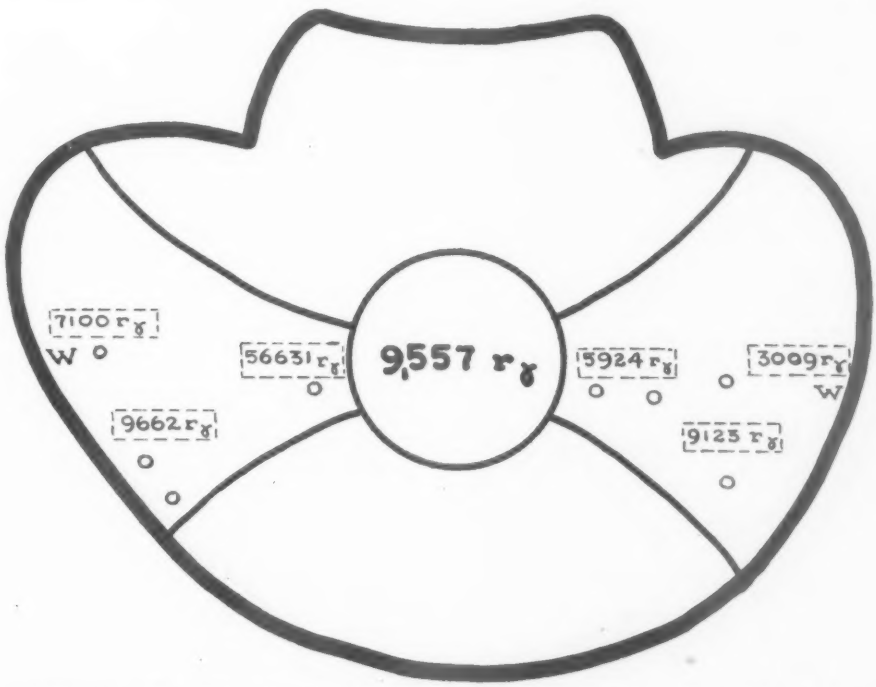

Fig. 7. Case III. Tracing of roentgenogram to show positions of centers of needles and doses in gamma roentgens in various parts of the parametrium. The details of the needles in the cervical mass are not shown.

is due to the fact that on the right side the needles lay in a plane parallel to the pelvic wall whereas on the left side they were placed in a triangular fashion.

In this pattern the dose is beginning to be adequate but the distribution of radiation is still "spotty," being completely adequate where the needles were close together but deficient in other areas.

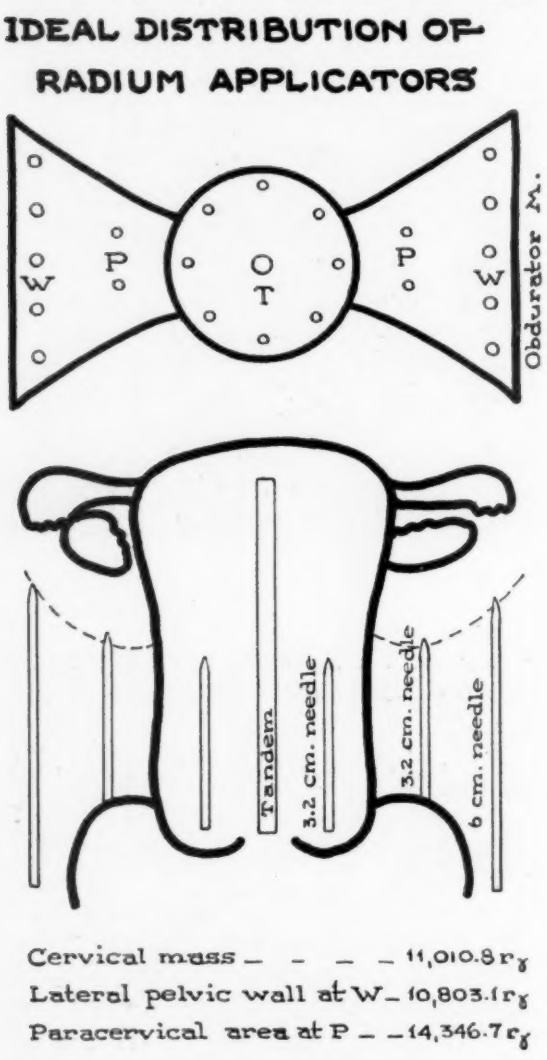

Fig. 8. Diagram to show arrangements of needles to deliver apparently adequate radiation to cervix, paracervical region and lateral parametrium.

We had learned, however, that we could introduce the needles with a considerable degree of accuracy into the positions previously planned. Therefore an arbitrary pattern was devised which delivers apparently adequate radiation to all points in the uterus and parametrium. In this pattern (Fig. 8) there are placed in the intrauterine tandem end to end three 10 mg. tubes. In the previous cases some overlapping of the tubes was necessary in order to get them into the available fountain pen reservoirs made of rubber. With the plastic tubes made to fit these capsules, such overlapping is unnecessary. About this tandem with a radius of 1.5 cm. were placed in stockade fashion eight 3.2 cm. needles.

One and a half centimeters lateral to this and 1 cm. apart in a sagittal plane were placed two 3.2 cm. needles parallel to the axis of the uterus.

One and a half centimeters lateral to these, or 4.5 cm. from the cervical canal were placed five 6 cm. needles parallel to the pelvic wall one centimeter apart.

With this pattern there will be delivered to the cervical mass 11,010.8 gamma roentgens.

To the paracervical region at "P" was delivered 14,346.7 gamma roentgens.

To the lateral parametrium near the pelvic wall at "W" was delivered 10,803.1 gamma roentgens.

Figures 9 and 10 are roentgenograms of a case in which this pattern was employed.

It is assumed that the needles can be inserted as indicated. It will be seen that the dose in the paracervical region is high. If two needles are inserted here, they must be at least 1 cm. apart. In most cases this is made possible by the increase in the anteroposterior dimension of this part of the parametrium by carcinomatous infiltration. In the lateral pelvic region three long needles can be inserted with ease. The anterior and posterior needles can be inserted in a normally distensible vagina.

In one of the preliminary plans a pair of paracervical needles were placed 1 cm. lateral to the stockade of needles in the cervical mass and another pair 1 cm. lateral to this. The radiation from this pattern was to our surprise excessive, giving in the paracervical region a dose of 16,679.4 and

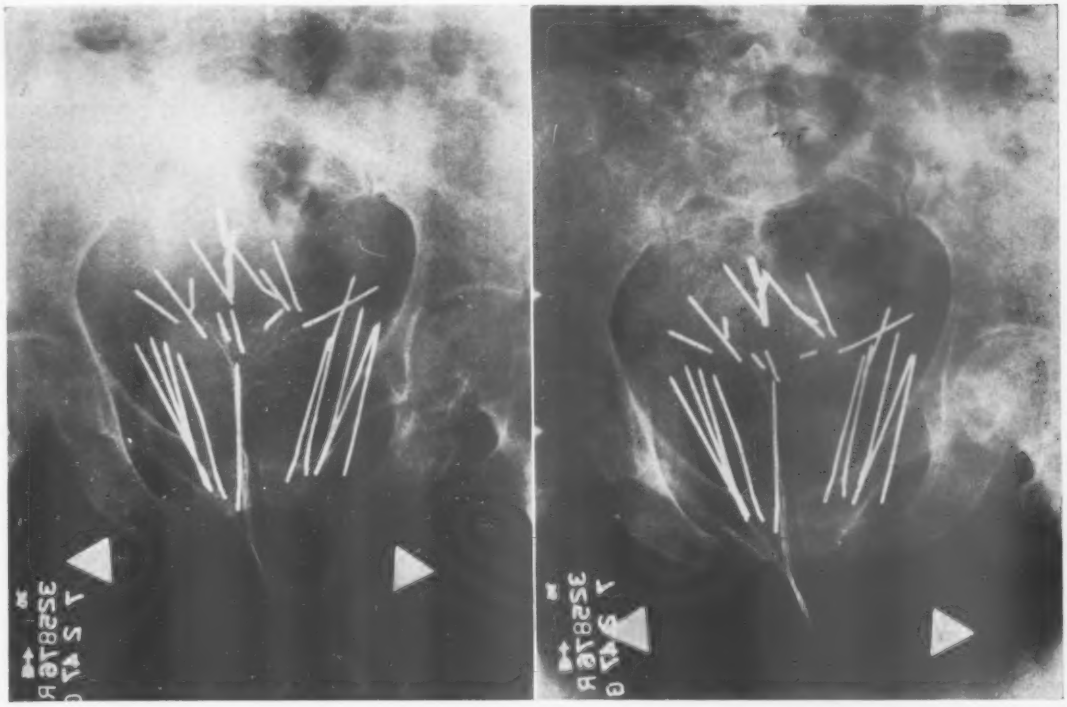

Fig. 9. Stereoscopic roentgenograms of needles inserted according to the plan in Figure 8.

in the lateral parametrium 11,022.7 gamma roentgens.

SUMMARY

These cases and a diagram are presented to show steps in the development of a pattern of distribution of radium units which will provide an adequate "tumor dose" of radiation to the cervical mass, the paracervical tissues and the parametrium out to its lateral limits. It was found that through a vagina which was not greatly deformed, the needles could be placed with considerable accuracy in the positions planned. At first by trial and error and later by calculation a pattern was devised (Fig. 8) which seems to supply adequate tumor doses to the desired places, i.e.,

Fig. 10. Lateral view of pelvis to show direction of uterine and parametrial needles inserted according to the plan in Figure 8.

To the cervical mass, 11,010.8 gamma roentgens.

To the paracervical tissues, 14,346.7 gamma roentgens.

To the extreme lateral parametrium, 10,803.1 gamma roentgens.

In the development of this plan it became apparent that needles, to be effective, must lie 1.0 to 1.5 cm. apart in the mass to be irradiated. Where, in the earlier cases the needles were farther apart than this, the areas between them received insufficient radium. These patterns are devised to fit the needles which are available to us. By employing weaker units set closer together, a still more homogeneous irradiation could be achieved.

Fig. 11. Sagittal section of female pelvis. (Reproduced by permission from "A Cross-Section Anatomy" by Eycleshymer and Schoemaker. D. Appleton-Century Co., New York, 1911.)

DETAILS OF TECHNIQUE

Anatomy. The axis of the uterus (Fig. 11) is nearly perpendicular to that of the body and in its normal position about 60 degrees to the axis of the vagina. This axis can be changed considerably by traction on the cervix unless there is fixation from carcinomatous infiltration or inflammation. Lack of care in ascertaining this axis accounts for the fact that occasionally needles in the posterior lip of the cervix perforate the posterior uterine wall and enter the peritoneal cavity.

The dimensions of the uterus are important because intrauterine tandems must reach the top of the cavity to destroy endometrium and prevent pyometra. The thickness of the cervical and uterine wall determines the amount of intrauterine radium, the number of needles in the uterus and their distance from the cervical canal. Thin walls, by the law of inverse squares, increase the liability of injury to bladder and rectum.

The paracervical (Fig. 12 and 13) and parametrial tissues occupy an area roughly shaped like a truncated pyramid whose apex lies against the uterus and whose base is on the obdurator fascia. The anterior limits are determined by the bladder and the posterior boundary by the posterior layer of the broad ligament. Inferiorly the

space merges with the paravaginal tissues. Superiorly the space thins out into the true broad ligament near the uterus and laterally is covered by the fascia over the round

base is about 6 cm. vertically and 6 cm. horizontally. The distance from the cervical canal to the obdurator fascia is about 5 cm. The sweep of the pelvis increases this

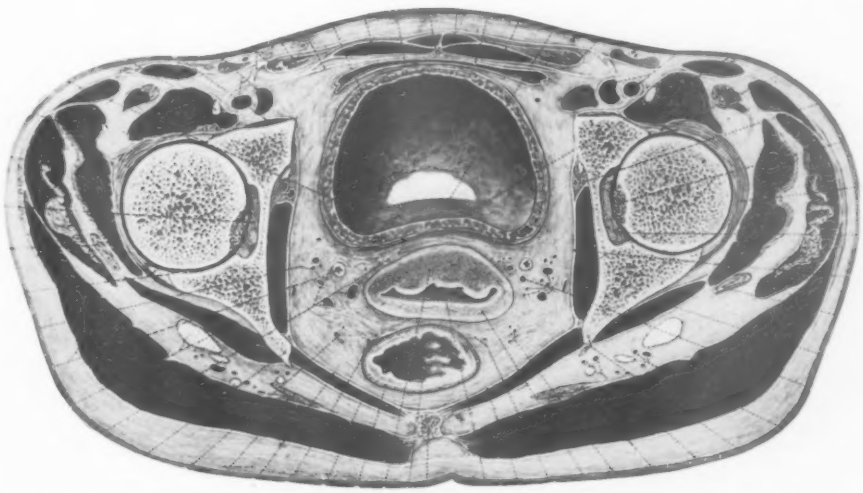

Fig. 12. Coronal section through female pelvis at the level of the tip of the cervix. (Reproduced by permission from "A Cross-Section Anatomy" by Eycleshymer and Schoemaker. D. Appleton-Century Co., New York, 1911.)

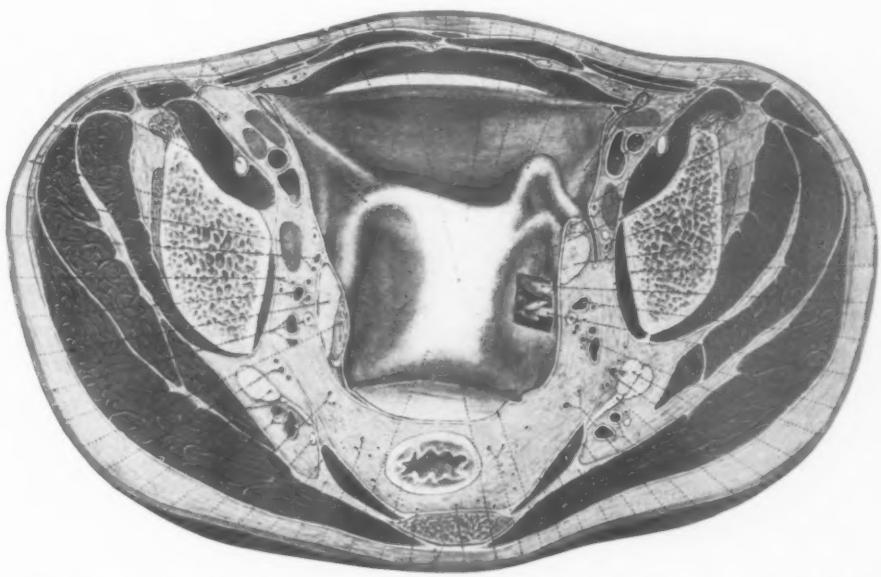

Fig. 13. Coronal section of female pelvis at the level of the fundus of the uterus. (Reproduced by permission from "A Cross-Section Anatomy" by Eycleshymer and Schoemaker. D. Appleton-Century Co., New York, 1911.)

ligament anteriorly and the infundibulopelvic ligament posteriorly. The dimensions of the truncated apex are about 2 cm. anteroposteriorly and 4 cm. vertically. The diameter posteriorly to about 6 cm. and narrows it anteriorly to about 4 cm.

The normal vagina is urn-shaped with considerable distensibility of the fornices

but in older persons and with carcinomatous involvement, may become a narrow elongated cone and may be distorted or held rigid by carcinomatous infiltration.

Radium Technique. The intrauterine tandem as in any intrauterine radium applicator should cover the full length of the cervical canal, the amount of radium being determined by the thickness of the uterine wall.

The needles introduced into the cervix are 3.2 cm. long and laid carefully parallel to the uterine axis. Those in the paracervical region lateral to the cervical stockade are likewise 3.2 cm. long and laid in the same axis. The needles in the extreme lateral position are laid parallel to the pelvic wall. This is accomplished by retracting the vaginal wall as far as possible laterally with a long narrow retractor. If there is no interference by carcinomatous infiltration, the tissues can be flattened against the lateral pelvic wall so that the needles at their point of entrance are almost against the obdurator muscle and can be inserted in a direction parallel to it. The point of entrance is at the junction of the middle and upper thirds of the vagina.

The pattern of distribution of the needles may be of two kinds, one in which the radiation units are distributed in the clinically apparent carcinomatous tissue and the other in which the units are placed so as to cover all the spots into which cancer of the cervix might spread, irrespective of the palpable mass. This is the pattern which we have employed—inserting the needles according to anatomical landmarks and inserting more needles only when the volume of carcinomatous tissue was so great as to permit the addition of extra needles without danger to the intestine or bladder and in such a manner that they will lie at least 1 cm. distant from any other needle. Other details such as the use of steel wires to control the needles, the preoperative preparation of the patient, preliminary external irradiation, packing of the vagina, the use of a self-retaining catheter, postoperative administration of sulfa drugs, and so forth, are conventional.

DISCUSSION

This is an effort to deliver to all accessible regions a dose adequate to destroy cancer without causing excessive injury to the normal tissue. It is assumed that irradiation has been selected as the best method for the particular case. With this decision made, it becomes academic whether the cancer is or is not sensitive to radiation either in the primary focus or in metastases in lymph nodes. Secondly, we predicate that the rays must be distributed not only to those areas in which the cancer is obvious but also to those in which it may exist in microscopic form.

The implanting of sources of radiation within the cancerous tissues in principle furnishes an ideal method for homogeneous irradiation. If the units are of small strength, they can be placed so as to furnish radiation, obviously greater immediately about the needles, but adequate in the spaces between. This is a simple matter of applying the principles elucidated by Paterson and Quimby. By introducing the sources of radiation directly into the cancer-bearing area, the dose will be maximum in the tumor and diminish rapidly as one goes centrifugally toward the hollow viscera.

The reliability of the measurements made with the precision stereoscope is high. In a test made by interns after six months' obstetrical training with a bony pelvis, the error between the measurements made with the stereoscope and those taken directly from the specimen was less than 2 mm.

While it is our purpose to present only a study of radium dosage to be obtained by interstitial irradiation, we cannot avoid some discussion of the practical problem involved. The principal objection to the method is that it is blind and that the radium needles are likely to injure intestines, bladder and ureter. It requires a pre-

cise knowledge of the anatomy of the pelvis, some degree of surgical dexterity and a knowledge of the principles of irradiation technique. It will hardly be popular with surgeons who do not care to study the principles and details of radium technique nor with radiologists who do not practice surgery.

The mechanical difficulties of inserting the needles in certain cases may be considerable. With the narrow conical vagina without fornices or one whose walls are held rigid or are distorted by carcinomatous infiltration, the manner of introducing the needles and their pattern may have to be altered, but except when the whole vagina is involved in a carcinomatous mass, these difficulties can be overcome, certainly much more easily than is the case with the intracavity method or with the vaginal cone.

Much has been made of the greater likelihood of injury to intestine, bladder and ureter through the use of this method. Mechanically the bladder is rarely injured because of the fact that needles, improperly placed, almost always point posteriorly and not toward the bladder. The ureter will not be injured because of the bluntness of the needles. The rectum or bowel might be injured by needles introduced into the posterior lip of the cervix. Improperly aimed, they perforate the posterior wall of the uterus and have been shown entering the peritoneal cavity. This is the responsibility of the operator. If he visualizes correctly the axis of the uterus, he need rarely allow the needles to go out of bounds. Injury to arteries is rare because of the bluntness of the needles. Injuries to veins probably occur frequently. In a small number of cases bleeding from the site of a needle puncture has been sufficient to require vaginal packing. We have observed no pelvic hematoma.

Radiation injuries by this technique are due to the same causes as with any other, primarily a neglect of two fundamental principles,—the use of small doses of radiation over a protracted period of time and the law of inverse squares. In the application of external roentgen irradiation the importance of the small daily dose of roentgen rays is almost universally recognized. In discussions of radium technique, the importance of this principle is often ignored or deliberately minimized, the statement being made that the administration of powerful radium units for a short time produces the same effect as weak units for a long time provided that the milligram hours are the same. The recognition of the law of inverse squares is necessary when the uterine walls are thin or when the posterior fornix is so obliterated as to bring the radium in the cervix close to the rectum.

In our experience with this technique, there have been no bladder injuries. In fact, vesicovaginal fistula in a woman cured of cancer is rare with any technique. We have had one rectovaginal fistula; this was in a patient suffering from a lymphogranulomatous stricture of the rectum, complicating the carcinoma of the cervix.

Infection would seem to be a real danger when needles are plunged through a necrotic mass into the underlying tissue. In our experience severe infection occurred in one of the earliest cases when a laterally directed 6 cm. needle evidently punctured the obdurator fascia and caused a deep abscess of the upper thigh.

Clinical results are not presented in detail. All of the cases treated had extensive involvement of the parametrium and were classified as Stage III (League of Nations). We will only say that the immediate results are striking and unmistakably superior to those following our use of the intracavity technique.

CONCLUSION

Eighty-five to ninety per cent of cases of cancer of the cervix uteri are suitable for no other treatment than radiation.

By the use of the precision stereoscope the location of the radium units can be accurately determined, the distances between them measured and the dose calculated.

By this means a pattern of distribution of radium needles in the cervix and parametrium has been developed which delivers a minimum dose of 10,803 gamma roentgens to the areas indicated.

While there may be areas still receiving insufficient radiation from this particular pattern, a method is presented by which such deficiencies may be measured and corrected.

An important conclusion is that dosage should be expressed in terms of the amount of radiation reaching the various points at which it is aimed. Radium dosage expressed in milligram-hours and roentgen-ray dosage expressed in roentgens delivered to the skin is only partially informative.

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Vol. 60, No. 4

THE RELATION OF TRANSITIONAL CELL BUDS, GOLGI APPARATUS AND MITOCHONDRIA TO CARCINOMA OF THE BLADDER*

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THE treatment of tumors of the bladder continues to be a subject of much controversy. Most clinicians are aware of the fact that every patient suffering hematuria has a possible tumor of the bladder until it is proved otherwise. The efficacy of diagnostic urography and cystoscopy is appreciated by all. It still remains for the urologist to evaluate the various therapeutic measures to thereby determine the best treatment for each individual case. The subject of grading as introduced by Broders has helped to indicate the best treatment in may instances. At the present time, many physicians interested in this subject are beginning to appreciate still another consideration which will have to be correlated together with grading. We refer to the differentiation between pedunculated and non-pedunculated or flat vesical neoplasms. The experience of several investigators would indicate that a low grade non-pedunculated or flat neoplasm has proved to be more clinically malignant than the relatively high grade pedunculated type. After a careful study of each patient, the clinical urologist will have to select the type of treatment which his experience would indicate to be best.

Although vesical neoplasms show wide variations in appearance, we are all agreed they take origin from the transitional cell. The tendency to create new terms for variation in cellular architecture and form is confusing. This practice frequently complicates the picture first for the general reader, and second for many therapists who have a lesser knowledge of cytological pathology. When elaborate detailed classifications are thoroughly analyzed the terms are usually descriptive of a cellular arrangement, a condition which is dependent upon rate of cellular growth. This variation can be adequately classified by the application of grading. For this reason these tumors can conveniently be classified into two relatively sharp categories, one papillary, the other infiltrating.

The most frequent picture is one in which a small papillary growth is found. Usually this neoplasm is both pedunculated and low grade. The consensus as to the best form of treatment for such cases is transurethral fulguration with periodic cystoscopic re-examination of the bladder to detect the earliest recurrence or appearance of a new tumor. This policy has proved to be very satisfactory for the majority of patients. It is interesting to note that even this best known category of vesical neoplasm is being treated in several other ways. Transurethral fulguration with the insertion of one radon seed in the site of the pedicle has yet to be thoroughly evaluated. Similarly, the results of irradiating the recurrences from previously fulgurated tumors in this group also remain to be evaluated. Another well recognized category is that in which multiple papillary growths of relatively low grade are found. Evidence has accumulated which would indicate that these lesions, if they have not extended beyond the muscular layer, are perhaps adequately cared for by extensive fulguration down to the muscle layer through a suprapubic cystostomy and followed by the implantation of radon seed. Here, as in all types of treatment short of total cystectomy, frequent re-examination of the bladder for recurrences

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must necessarily be made to evaluate the results and to be on the alert for recurrent neoplasms. There are several workers in this field who advocate total cystectomy and ureterosigmoid transplantation for such cases. The efficacy of this plan of treatment yet remains to be accurately evaluated. Particularly for the flat infiltrating tumor one must endeavor to determine the extent of the infiltration. While at best such a study has definite limitations, the use of pneumocystography and bimanual examinations of the bladder under anesthesia has proved most informative to many. For the extratrigonal tumor that has not invaded beyond the muscle of the bladder, there are many who would advocate suprapubic segmental resections of the bladder. There are also those who recommend suprapubic fulguration with radon seed implantation and still others who consider total cystectomy with ureteral sigmoid transplantation. The latter two types of therapy have an equal number of enthusiasts for the trigonal infiltrating type of tumor. As with all other malignant neoplasms of the body, there are those cases with extensive infiltrating lesions both with and without metastases. This group is being treated by many urologists with roentgen therapy. As with all conditions in which numerous methods of therapy have been and are being advocated. the clinician is well aware of the fact that no treatment approximates being a panacea. At the present time, there remains for evaluation several additional therapeutic plans. We await learning the effect of the intravenous administration of radioactive materials on all the types of vesical neoplasm and the radon cystoscopic bomb.

If there is a condition in which the patience, judgment, and skill of the physician is to be tried, the management of vesical neoplasms ranks high on the list. Similarly, if there is a condition in which the value of early diagnosis has best proved itself, the management of vesical neoplasm stands foremost. It could well be said that the best treated bladder tumors are those in which the following sequence of events occur; the patient promptly consults his physician immediately after having suffered hematuria; the physician then promptly subjects the patient to urologic investigation. Such cooperation would serve well to remedy what most optimistic urologists deem a bad situation.

Unfortunately an accurate comparison of the four different methods of treatment, namely: fulguration, irradiation, segmental resection and total cystectomy, is impossible. This is due to wide variation in many factors. Some of these are wide variation in grade or cellular arrangement, age of patient, duration of lesion, variation in degree of perfection in each particular treatment method. These are but a few of the factors which make it impossible for an accurate comparison of the different methods of treatment.

When large series of all methods are analyzed the improved end results are usually due to a mastery of the technique applied. In spite of the increase in the average duration of life after the treatment of carcinoma by any of the four methods they must be considered to be inadequate.

The preceding enumeration and brief discussion of the present status of the treatment of carcinoma of the bladder shows that the outlook for this group of patients is relatively unsatisfactory. The purpose of this study has been to try to establish a better understanding of the biological behavior of these tumors. This was done with the hope of improving our present efficacy of treatment. The project consists first, of a study of the distribution and arrangement of the transitional cells; second, a cytological study of the Golgi apparatus and mitochondria found in malignant and non-malignant cells.

The presence of submucosal epithelial buds in the transitional cell covered tissues of the bladder was discovered by von Brunn in 1893. In a previous report he describes cell nests in the ureter in 38 out of 54 consecutive autopsy specimens. These areas are identified as transitional cell buds. They

are somewhat irregular in outline and imperfectly differentiated. Without entering into a discussion concerning the pathogenesis of submucosal cell nests, most observers are agreed that their appearance is very suggestive of susceptibility to activity of growth. In a previous report of 6 surgical specimens it was shown that the early changes which first involve the submucosal epithelial supporting tissue are inflammatory in type. This is followed by proliferation of the basal layer which eventually becomes papillary or infiltrating. These observations are in accord with the animal experiments in which carcinogenic hydrocarbons have been used to produce carcinoma.

The literature contains more than coincidental evidence that the anatomic distribution of these cell nests may be closely associated with the tumors we are discussing. The multiplicity of the epithelial buds in the renal pelvis, ureters and bladder is in accord with and very suggestive of the source of subsequently developed tumors. Frequently we destroy a bladder tumor only to find at a later examination that another has developed at a distant area. The removal of a kidney for papillary carcinoma of the pelvis is frequently followed by tumor development in the remaining ureter. When the kidney and ureter are removed for tumor of the kidney pelvis this is frequently followed by the development of bladder tumors. These factual clinical observations are very suggestive that the subsequent tumors probably develop from the epithelial cell nests described above. This course of events also suggests very forcefully that the stimulating substance which has caused the tumor growth is still active. It also suggests that the activation of these cell nests should be dependent upon changes in susceptibility to activation.

If this hypothesis be true (granted it has not been proved) how may these immature, imperfectly differentiated cell nests be rendered inactive or unsusceptible to growth? An approach may be by subjecting these cells to roentgen therapy. In support of this possibility 5 patients are presented. These patients were first seen in 1936. They all had low grade multiple papillomas of the bladder. Three were treated by roentgen therapy. This therapy established no appreciable change in the gross appearance of these tumors. They were subsequently destroyed by transurethral fulguration.

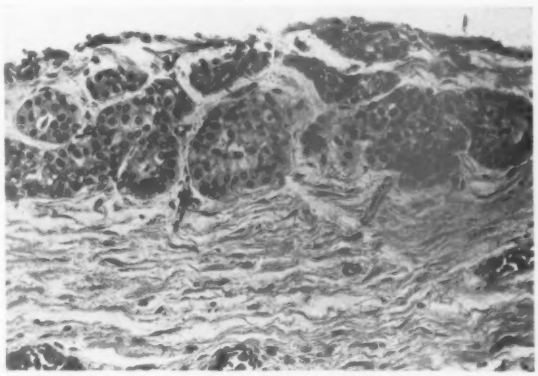

FIG. 1. This photomicrograph shows subtransitional cell buds. They may be single, double or multiple. Note the imperfect differentiation.

The frequent follow-up cystoscopic examinations have never revealed any evidence of recurrence. The other 2 patients were treated only by transurethral fulguration. These patients continue to develop new tumors in other areas in the bladder. These appeared at intervals ranging from three months to one year.

In 1945 after a discussion with Dr. E. P. Pendergrass we both agreed to give one of these patients a course of roentgen therapy over the bladder region. Except for three scattered small areas of bladder mucosal hyperemia the roentgen irradiated bladder has been free from recurrence. The other patient (non-irradiated one) continues to have new tumors develop. If we may consider the recurrences due to susceptible epithelium or susceptible epithelial nests, it may be assumed on hypothetical grounds that the roentgen therapy established changes in this epithelium which rendered the tissue less susceptible to carcinogenic irritation. Although the number of cases is

insufficient to draw definite conclusions the comparative difference in the clinical course is thought provoking.

With the hope of establishing a better understanding of the biological behavior of bladder tumors the Golgi apparatus and mitochondria have been studied. The original description by Golgi in 1898 was

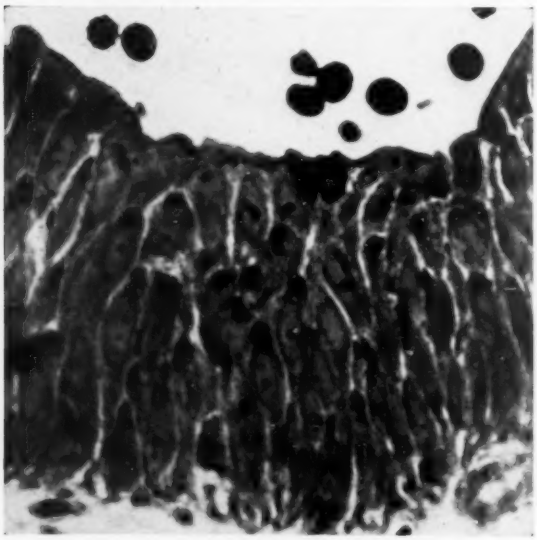

Fig. 2. This is a section of a papillary carcinoma of the bladder, Grade 2. It shows the mitochondria with a lesser tendency to form a juxta-nuclear clump than has been seen in the normal control. Also the mitochondria appear to be more generally distributed throughout the cell.

followed by a voluminous array of literature. Although there are over two thousand publications about the Golgi apparatus most of the observations refer to findings in animal and plant life. Apparently no attention has been directed about the Golgi apparatus or mitochondria in human or animal bladder tumors. For purposes of definition it has been stated that the Golgi apparatus is a structure within cells which is blackened by osmic acid or by silver salts. It is distinct from finer articulate matter which may be similarly blackened. It is interpreted by different writers as fluid, semifluid, or solid, and is sharply separated from the surrounding cytoplasm so that its surfaces constitute interferences on which metals and a few dyes may be absorbed. It has been variously described as a series of canals or of vacuoles or as threads of lipoid material. In epithelial cells the usual position of the Golgi apparatus is in the cytoplasm distal to the nucleus, i.e. between the nucleus and free surface.

The mitochondria have also been studied intensively but with less divergence of view regarding their reality or their physical nature. They have been separated by centrifugation and subjected to chemical analysis. This has shown them to be a lipoprotein complex. They are subject to great variation in number and form, and most of the studies made on them have been empirical efforts to correlate these changes with previously known or new experimental conditions.

There were 15 bladder tumor specimens examined when possible normal or at least uninvolved tissue was obtained for controls. This preliminary study was recently reported in detail at the Fourth International Cancer Research Congress by the author, Hastings and Dalton, with the conclusion that several cases of the same tumor type have shown changes. Although that report referred to 290 operative specimens, only the vesical neoplasms will be referred to in this paper. The study showed differences from the normal pattern of the Golgi apparatus and in the number, size, and shape of the mitochondria. In certain instances changes have been found consistently in several tumors. The changes, as far as the Golgi apparatus is concerned, may be reversal, or extension away from the nuclei membrane; or increase in amount. The mitochondria show, in some instances, an increase in number and decrease in size. In others, the reverse is true.

Although the preliminary report on the Golgi apparatus and mitochondria studies does not warrant definite conclusions, the findings have stimulated our continued interest. We think the changes may prove of value in giving evidence as to relation between cytogenic changes and prognosis in cases of bladder papillomas.

During the past decade the vast accumu-

lation of information about chemical carcinogens has not been sufficiently emphasized. While it is not within the domain of this presentation to discuss carcinogenic substances it is possibly a cause of activating the transitional cell nests. Occupational carcinoma among chimney sweeps was recognized as early as 1775. The carcinogenic potency of the complex hydrocarbons has been described and proved experimentally. Physiological chemicals have been described as factors in the etiology of carcinoma. Although inconclusive chemically the potency of estrogenic substances has been proven to produce mammary carcinoma in carcinoma strains of mice. Bile acids, cholesterol, vitamin D and sex hormones are other physiological chemicals under inconclusive consideration. The detection of carcinoma of the urinary bladder among aniline dye workers has been known since 1895. The azo dyes have been proved to be carcinogenic agents. Since a systemic chemical basis for carcinoma is not without stimulating evidence, it seems that the immature buds may be the tissue susceptible to activation. The predominant clinical impression is that a patient who has a tumor of either the renal pelvis, the ureter, or the bladder can have or may develop a tumor in any other of these locations. It is because of the keen appreciation of the association between these cell buds and the transitional cell type of tumor that one should consider a modification of the accepted policy of treatment. Any mechanism which could arrest or prevent the activation of cell buds should be very helpful.

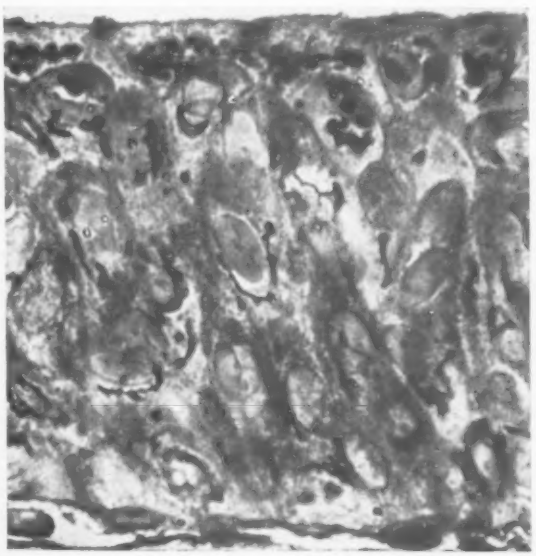

Fig. 3. Papillary carcinoma, Grade 1. This shows the reversal of the Golgi apparatus in the middle zone but with normal position in the more superficial and deep-lying cells.

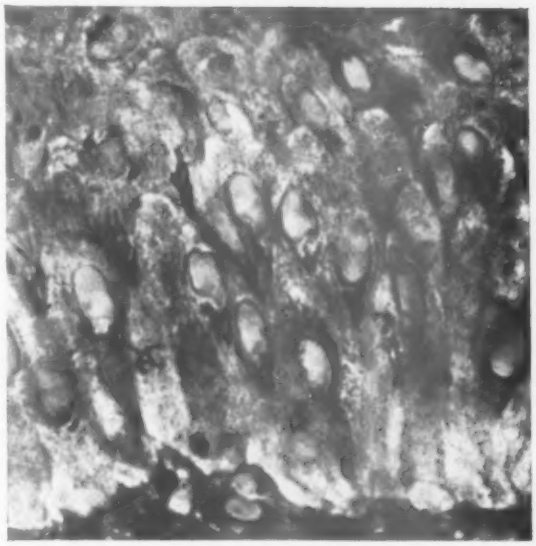

Fig. 4. Papillary carcinoma of the bladder, Grade 2. This shows more complete reversal of the Golgi apparatus. In the normal controls the Golgi apparatus was toward the surface.

Our present policy is to follow the radical surgical procedure with roentgen therapy over the remaining areas covered by transitional cell epithelium. This will include the entire remaining urinary tract. While the patients thus far studied are too few and sufficient time has not elapsed, the follow-up on bladder tumor patients treated this way has given increased courage to advise this postoperative therapy for patients with carcinoma of the renal pelvis, ureter, and bladder.

SUMMARY AND CONCLUSIONS

1. A simplified classification of bladder tumors is suggested.

2. The possible association between tran-

sitional cell nests and bladder papillomas has been discussed.

3. Postoperative roentgen therapy is advised for the remaining areas in the urinary system covered by transitional epithelium.

4. Differences from the normal pattern of the Golgi apparatus and in the number, size and shape of the mitochondria of normal cells have been noted in human bladder tumors.

5. The changes as far as the Golgi apparatus is concerned may be reversal with relation to the nucleus.

The studies of the Golgi apparatus and mitochondria were carried out at Jeanes Hospital, Philadelphia, under a grant from and in cooperation with the National Cancer Institute, Bethesda, Maryland.

The author wishes to thank Willard Hastings, M.D., and Albert J. Dalton, Ph.D., for their cooperation in this study.

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DISCUSSION

Dr. Eugene P. Pendergrass, Philadelphia, Pa. Dr. Bothe in his paper has commented briefly on the present method of treatment, some of the reasons for the poor results, and has described an approach which he hopes will lead to a better understanding of the biological behavior of bladder tumors. His investigations are concerned with the submucosal transitional cell buds, the Golgi apparatus, and mitochondria. My experience is such that I cannot discuss the relationship of the Golgi apparatus and mitochondria as it concerns the treatment or prognosis of bladder tumors, but I would like to reëmphasize a few points about vesical neoplasms.

Cancers of the bladder are commonly found in urologic practice, probably the most common. A large number are far advanced at the time treatment is instituted, because of the delay on the part of the practicing physician and most patients. Hematuria and vesical discomfort are the early symptoms in most instances. Carcinoma of the bladder is the most frequent cause of hematuria.

Tumors of the bladder are usually primary, although as Dr. Bothe said this morning, one may observe a tumor developing in the bladder following the removal of either a kidney or the kidney and ureter. The diagnosis can be made by cystoscopy and biopsy in most instances, the Papanicolaou test in some, bimanual palpation of the bladder by vagina or rectum under anesthesia to determine extravesical extension, the use of barium enemas, urographic and cystographic studies. In other words, what I am trying to say is that a complete diagnosis of the extent of the disease is important before any treatment is instituted.

It may be necessary in some instances to do an exploratory operation, and by exploratory operation I mean a laparotomy and cystotomy to determine whether the disease is confined to the bladder or has extended beyond.

I think Dr. Jewett's and Dr. Powell's slides that Dr. Bothe showed here this morning are a good illustration of the reason for that procedure.

Although the type of tumor is important, Jewett feels that the most important component is the extent to which the tumor has penetrated the bladder wall. The recent trend in the treatment of carcinoma of the bladder has been toward radical surgery. In a recent paper Marshall reported the experiences of Memorial Hospital in patients treated by irradiation, and he stated that they parallel the survival rate of cases reported by Welch and Nathanson in Boston; in other words, the life cycle was approximately 18.8 months.

If irradiation is employed—and it should be in many instances—one should not give so much irradiation that the effect will make the patient more uncomfortable then the discomfort experienced by the patient with the original lesion.

Dr. Bothe's concept that submucosal transitional nests of epithelium may be located in various parts of the bladder and predispose to new tumor formation, and that these nests should be irradiated, is most interesting. I am sure he meant to say that these submucosal cell nests occur not only in papillary tumors but also in carcinoma. If these transitional cells are susceptible to irradiation, one may at least prevent new growths.

Dr. Lenz has asked that I discuss the technique that we employ. Dr. Bothe in this work has, I believe, shown a very good reason why one should do postoperative irradiation even when segmental excision is carried out in these lesions. He also shows that even after cystotomy, one should consider doing postoperative

irradiation over the entire urinary tract; that is, the remaining kidneys and the ureter; and he bases that concept upon the study of cases showing these transitional cell nests distributed throughout the urinary tract. I do not know whether time is going to prove that this is a valuable procedure or not, and neither does Dr. Bothe. My own thought about it is that we should try this out and that we should anticipate that these transitional cell nests are susceptible to irradiation, and that the dosage should not be too large. My own thought is that 1,000 r should be delivered into the area of the kidney, pelvis, ureter, and residual bladder. These are done by daily dosages of 200 r, using fields that are adequate to cover those areas. Those fields measure about 15 by 16, or 15 by 20 cm.

Dr. Maurice Lenz, New York, N. Y. I wanted to know particularly whether you do this for carcinoma or only for papillomas.

Dr. Pendergrass: I believe it should be done in carcinoma and papillomas of the bladder.

Dr. Lenz: The same doses?

Dr. Pendergrass: The same doses.

Dr. Gordon E. Richards, Toronto, Canada. Having had no experience in the methods proposed by Dr. Bothe, I really have no right to take part in the discussion, and the chief comments I have to offer are to suggest that the degree of imagination which has been put into this investigation is one that is very stimulating indeed. The study of cell rests throughout the body is not new, and their significance in connection with the later development of various types of malignant disease has frequently been referred to. Whether an analogy may be drawn between these cell rests occurring in the urinary tract and those occurring in the neck, I do not know. We think we have observed in branchiogenic carcinoma, which may occasionally be due to the development of carcinoma from cell rests, that the degree of sensitivity is higher than in ordinary or more commonly occurring secondary carcinoma from other types of lesions in the neck.

The amount of material which has been submitted for study by irradiation is too small, as Dr. Bothe mentioned, to justify any very sweeping conclusions, but if the statements made justify the suggestion offered, there should be opened up a field of considerable usefulness. Most of us, I think, have been moderately disappointed with the results of radiotherapy in bladder tumors, and are equally convinced that in the future prevention, where it is possible, is more important than attempts at cure, and this suggestion seems to offer that as a possibility.

The matter of technique has been covered by Dr. Pendergrass and I can only accept his statements with some reservations. I do not know whether 1,000 r would actually be sufficient unless it is regarded simply as an inhibitor. If we may reason from analogies elsewhere in the body, unless these cell rests are very radiosensitive, it would not be a sufficient dose to be destructive of carcinoma cells.

I would like to close by thanking Dr. Bothe for a very stimulating paper, which illustrates once again that often more progress is made by the detailed study of small groups than by more diffused studies of very large groups of cases. This has, to me, been a thought-provoking and stimulating paper from which I hope something useful will come in the future.

Dr. Maurice Lenz, New York, N. Y. The tumor dosage given prophylactically by Dr. Pendergrass to Dr. Bothe's cases of papilloma would, I believe, be inadequate to control bladder cancer. In a five to fifteen year follow-up study of 46 patients with cancer of the trigone treated by radium needles and cystostomy and reported in the American Journal of Roentgenology and Radium Therapy, 1947, Vol. 58, pp. 486–491, we found clinical freedom from cancer in 16 per cent if the tumor dose was less than 8,000 gamma roentgens and nearly 33 per cent when it was over this amount.

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Thirty-first Annual Meeting: Atlantic City, 1949.

EDITORIAL

THE ANNUAL MEETING OF THE AMERICAN ROENTGEN RAY SOCIETY

AT THE Forty-ninth Annual Meeting of the American Roentgen Ray Society held in Chicago from September 14 to 17, 1948, radiology undeniably was placed on the highest pedestal of its comparatively short but very fruitful existence. The latest technical achievements and especially the breath-taking progress in the solution of some of the most intricate atomic phenomena were reflected amply in the subjects of a Scientific Program already embodying medical topics of rare and unusual interest.

The opening ceremony on Tuesday morning was an inspiring affair. After the Call to Order and Presentation of the Scientific Exhibit awards of the previous year's meeting by President J. Bennett Edwards, a cordial welcome was extended to the Society by Dr. J. Roscoe Miller, Dean of Northwestern University Medical School and President of the Chicago Medical Society. Dr. Vincent W. Archer, Chairman of the Executive Council, then in a heartfelt speech installed President-elect Lawrence Reynolds as the new President of the Society. Dr. Reynolds in an eloquent inaugural address vividly expressed the trend of the new developments which were to dominate the meeting. He humbly recalled how within one generation the "unicellular plant" originating in the basement of a hospital has grown into a modern department forming the keypoint at the "crossroads of the hospital corridors" from which "knowledge is disseminated in many directions to the benefit of the patient and to the advancement of medical progress." Then, after paying tribute to many illustrious members of the Society who actively participated in this great work, he reviewed the important role radiology played in the development of some allied sciences which figuratively speaking were "spawned" by radiology. Now, radiology finds itself at the threshold of a new era. "We have entered new fields of scientific investigation," said Dr. Reynolds, "involving to a great degree relativity rather than the absolute with which scientists were accustomed to deal and as a result of the application of atomic fission in medical research science has come to regard the human being as an exquisitely constructed physiochemical mechanism." But he also cautioned that "the headlong, almost untrammeled, advances of science in its search for truth has led us into perilous situations."

Following this thought-provoking address the members of the Society were treated to an excellent round table discussion on "Bronchogenic Carcinoma" by Drs. William M. Tuttle, John R. McDonald, William E. Adams, and Leo G. Rigler. The large number of written questions placed from the floor attested to the popularity of this discussion.

The afternoon session was taken up entirely by a symposium on "Congenital Heart Disease." The clinical, roentgenographic and surgical aspects were presented by men with great authority in their respective fields. Considerable attention was paid to cardiovascular angiography, and Dr. Wendell G. Scott presented the so-called tautograph which serves for the automatization of the roentgenographic technique in cardiovascular and angiographic examinations. This apparatus is capable of making rapid serial roentgeno-

grams of short exposure, thus avoiding excessive irradiation of the patient. Dr. C. Rollins Hanlon in discussing the surgical aspect gave a statistical analysis of the results obtained in 650 cases of congenital cyanotic heart disease at the Johns Hopkins Hospital. He also showed an excellent moving picture in colors illustrating the operative technique and some unusual operative findings.

On Wednesday morning another interesting panel discussion on the "Diagnosis and Treatment of Diseases of the Chest" was given by members of the regular weekly chest conference of the Hospital of the University of Pennsylvania, with Dr. Eugene P. Pendergrass acting as moderator. The participants were Drs. Julian Johnson, Simon Leopold, Joseph Atkins, Julius Comroe and Robert P. Barden, representing the surgeon, internist, bronchoscopist, physiologist and radiologist on the panel. Mimeographed résumés of the cases discussed were distributed to the audience so that the problems involved could be more easily followed. The program was conducted in the same manner as the regular hospital conference, emphasizing the great value of group consultation.

The interest in the roentgen study of the chest is so great that the first half of the afternoon session was also devoted to topics on this subject. Dr. A. C. Christie gave a masterful paper on the "Medical and Roentgenological Aspects of Mass Chest Surveys," with particular emphasis on the results of the Washington Survey with respect to the percentage and type of tuberculous and other lesions discovered, and the value and type of subsequent roentgen examinations. Other papers were: "The Angiocardiographic Diagnosis of Syphilitic Aortitis" given by Dr. Charles Dotter; "The Fate of Oil Particles in the Lung and Their Relationship to the Development of Bronchiogenic Carcinoma; a Roentgenological and Pathological Study" by Dr. L. R. Sante; "Hemosiderosis of the Lung Due to Mitral Disease; a Report of Six Cases Simulating Pneumoconiosis" delivered by Dr. Edwin L. Lame and "The Role of Nitrogen Mustard as an Adjunct to Roentgen Therapy of Malignant Diseases" presented by Dr. Bernard Roswit.

The second half of the Wednesday afternoon session was given over to a symposium of the utmost importance as regards future possibilities in the construction of more sensitive roentgenoscopic units. The symposium dealt with the "Intensification of the Roentgenoscopic Screen" but in the discussion that followed the progress in the design of "the scanning roentgen-ray tube" was also considered. As an introduction, Dr. W. Edward Chamberlain gave a brief review of the "Present Day Roentgenoscopes and Their Deficiencies." He stated that because of the low visual acuity which an observer has at the brightness levels occurring during roentgenoscopy, often roentgenographic procedures are preferred. Dr. Ralph E. Sturm then analyzed the "Fundamental Limitations of Screen Intensifying Systems" and showed that at low levels of illumination the performance of all optical devices (including the eye) is largely limited by statistical fluctuations in the number of light photons reaching the device during the observation of an event. He also discussed the magnitude of these fluctuations existing under ordinary roentgenoscopic conditions and under conditions likely to occur with various intensifying devices, such as the Langmuir image tube, the Moon scanning system and the Coltman image tube. In the next paper Dr. John W. Coltman presented in detail his "New Image Tube for Brightening the Roentgenoscopic Screen." The arrangement permits the light from a fluorescent screen to eject electrons from a transparent photoelectric surface, accelerating these electrons and bombarding a second fluorescent screen with them. The new tube will brighten the image 500 times. Finally, Drs. Russell H. Morgan and John F. Roach described the "Clinical Potentialities of Screen Intensification." A tube that has a gain of approximately 300 times was tested in the Department of Roentgenology

at the Johns Hopkins Hospital for the past few months. The detail of the anatomic structures appeared four times as sharp as that provided by conventional roentgenoscopes. In the discussion that followed Dr. Robert J. Moon gave a brief account of the latest progress in the construction of a "scanning roentgen-ray tube" which forms part of his amplification system reported in the June, 1948, issue of this JOURNAL. The entire symposium was very appropriately under the chairmanship of Dr. Russell H. Morgan who has contributed so notably toward the improvement of roentgenologic apparatus during the past decade. The essayists were honored by the presence in the audience of Dr. W. D. Coolidge.

An appropriate climax of this very profitable day was the Caldwell Lecture which was delivered in the evening by Dr. B. R. Kirklin, a distinguished former President of the Society. The introduction was made by Dr. Lyell C. Kinney in his customary polished style. Dr. Kirklin spoke on "Graduate Education in Radiology," a subject for which he is particularly equipped considering his long experience in the dual capacity of Director of the Instruction Courses of the American Roentgen Ray Society and Secretary of the American Board of Radiology. His words carried great authority and the suggestions made will undoubtedly have an outstanding part in fashioning programs for the best training of future radiologists. At the close of the lecture the Caldwell Medal was presented in a few well chosen words to Dr. Kirklin by President Reynolds.

On Thursday a splendid symposium on "Radiobiology," presided over by Dr. H. M. Parker, constituted the highlight of events. This symposium occupied the entire morning session and half of the afternoon session. Its participants were the leading scientists in their respective fields, coming from all sections of the country. The subjects discussed were not only of unsurpassed interest in relation to radiology but they were also of the utmost timeliness as concerns their general practical importance. They included: "Findings on Total Body Radiation from Nuclear Sources" by Dr. Shields Warren; "Recent Developments in the Study of Radiation Effects on the Hematopoietic System" by Dr. Leon O. Jacobson; "The Effect of Ionizing Radiations on Enzymes and Proteins" by Dr. E. S. Guzman Barron; "Radiobiological Additivity of Various Ionizing Radiations" by Dr. Raymond E. Zirkle; "Some Biologic Effects of Long Continued Irradiation" by Dr. Egon Lorenz; "The Metabolic Properties of the Fission Products and Actinide Elements" by Dr. Joseph G. Hamilton; "The Influence of Radiation Exposure on Length of Life of Laboratory Animals" by Dr. Robert D. Boche, with a very competent general discussion by Dr. Edith H. Quimby and Dr. Paul Aebersold.

The second half of the Thursday afternoon session was devoted to papers dealing with the physical and clinical problems of radiation therapy. Dr. G. Failla and Dr. H. H. Rossi discussed the "Dosimetry of Ionizing Particles." The difficulties in measuring tissue doses for beams of various ionizing particles (electrons, protons) and neutrons in terms of r were examined. The opinion was expressed that an ionization chamber in which both the wall material and the gas are tissue equivalent may serve a good purpose. Dr. Lauriston S. Taylor analyzed the "Problems of Dosage Measurements for Radiations Above 1 Mev.," and he arrived at the conclusion that in the range of high energies the r is not sufficiently flexible, necessitating complete revision of the dosage measurement. In another paper Dr. G. D. Adams, representing a group of seventeen men working under the guidance of Dr. Donald W. Kerst reported on the "Techniques for Application of the Betatron to Therapy." He described in particular the procedure which was used in treating a case of glioblastoma with 22 mev. The day's program was concluded with two papers on therapy, one by Drs. T. Leucutia and James C. Cook on "Malignant Degeneration of Benign Giant Cell Tumor of Bone," and

the other by Dr. Bernard P. Widmann on "Cancer of the Lip" in which he reviewed more than 300 cases treated over a period of twenty-five years.

There was a group of six very interesting papers on Friday morning. These included the following: "Relative Incidence of Bone Lesions, Including Fractures" by Dr. Sherwood Moore; "The Roentgen Examination of the Cervical Spine" by Drs. Joseph C. Bell and James B. Douglas; "The Relation of Therapeutic Radiology to Clinical Medicine" by Dr. A. U. Desjardins; "Intravenous Urography in the Study of Vesical Neck Obstruction" by Dr. W. J. Engel; "Deformities of the Bladder Secondary to Ureteral Stone" by Drs. Harold O. Peterson and Barnard Hall, and "The Early Diagnosis of Gastric Cancer by Photofluorography" by Drs. John F. Roach, Robert D. Sloan, and Russell H. Morgan. On Friday afternoon the following seven excellent papers were given: "The Occurrence of Gastric Ulcer in Diaphragmatic Hernia" by Drs. Glenn F. Miller and Howard P. Doub; "Gastrointestinal Food Hypersensitivity as Shown by the Roentgen Ray" by Drs. E. J. Tallant, Frederick Urbach and Hugh A. O'Neill; "A Rapid Method of Roentgenologic Examination of the Small Intestine" by Drs. Sydney Weintraub and Robert G. Williams; "Subacute (Pseudotuberculous) Thyroiditis and Its Treatment" by Drs. John D. Osmond, Jr., and U. V. Portmann; "Some Partial and Complete Obstructions of the Respiratory Tract in the Newborn Due to Tracheobronchial Malformations" by Dr. W. A. Evans; "The Time Factor in Cerebral Angiography and the Automatic Seriograph" by Drs. J. M. Sanchez-Perez and R. A. Carter, and "Bone Involvement in Cryptococcosis (Torulosis)" by Dr. Vincent P. Collins. It is impossible in this limited space to give even an abbreviated account of the many important topics embodied in these papers and the fine thought-provoking discussions that followed. Suffice it to say that when the end of the day came, a large audience was still present to witness the ringing down of the final curtain on the Forty-ninth Annual Meeting.

The other aspects of the meeting were equally successful. The Instruction Courses which this year were so ably organized by Dr. Harry M. Weber were exceedingly well attended. The Scientific Exhibits arranged by the Committee under the Chairmanship of Dr. Wilbur P. Bailey were most attractive and enjoyed great popularity. The Technical Exhibits were splendidly assembled and disposed. The many new apparatus, instruments and devices displayed created unusual interest and the various exhibitors gave generously of their time in furnishing the necessary explanations.

The social program deserves special mention. The Annual Golf Tournament arranged by the local Chairman, Dr. Warren W. Furey, was held Monday at the Bunker Hill Golf Club, Niles, Illinois. It consisted of luncheon, an eighteen hole match for the Willis F. Manges Trophy and the Exhibitors' Trophy, and an excellent dinner. On Wednesday evening, following the Caldwell Lecture, there was a delightful party, at which the Chicago Roentgen Society was host. The Annual Banquet on Thursday evening was a gala affair, with some unusual entertainment, splendid music, and gaiety and dancing lasting into the early morning hours. The Society is grateful to Dr. R. A. Arens, and his Committee on Local Arrangements and to Mrs. R. A. Arens and her Ladies' Committee for their competent and efficient work.

To the executive staff and personnel of the Palmer House the Society desires to express its thanks for the capable management of the meeting and the many courtesies extended to the members and guests.

It was an excellent meeting in every sense of the word. Dr. Reynolds and his Program Committee can derive pleasure and satisfaction in the knowledge that their untiring efforts have been rewarded with splendid success. T.L.

SOCIETY PROCEEDINGS, CORRESPONDENCE AND NEWS ITEMS

Items for this section solicited promptly after the events to which they refer

MEETINGS OF ROENTGEN SOCIETIES*

United States of America

American Roentgen Ray Society
Secretary, Dr. H. Dabney Kerr, University Hospital, Iowa City, Iowa. Annual meeting: Netherland Plaza Hotel, Cincinnati, Ohio, Oct. 4–7, 1949.

American Radium Society
Secretary, Dr. H. F. Hare, 605 Commonwealth Ave., Boston, Mass. Annual meeting: Atlantic City, 1949.

Radiological Society of North America
Secretary, Dr. D. S. Childs, 607 Medical Arts Bldg., Syracuse, N. Y. Annual meeting: Hotels Fairmont and Mark Hopkins. San Francisco, Calif., Dec. 5–10, 1948.

American Collegeof Radiology
Executive Secretary, William C. Stronach, 20 N. Wacker Drive, Chicago 6. Annual meeting: 1949, to be announced.

Section on Radiology, American Medical Association
Secretary, Dr. U. V. Portmann, Cleveland Clinic, Cleveland, Ohio, Annual Meeting: 1949, to be announced.

Alabama Radiological Society
Secretary, Dr. C. S. Stickley, 515 Bell Bldg., Montgomery, Ala. Next meeting time and place of Alabama State Medical Association.

Arkansas Radiological Society
Secretary, Dr. Fred Hames, 511 National Bldg., Pine Bluff, Ark. Meets every three months and also at time and place of State Medical Association.

Brooklyn Roentgen Ray Society
Secretary, Dr. A. H. Levy, 1354 Carroll St., Brooklyn 13, N. Y. Meets monthly on fourth Tuesday, October to April.

Buffalo Radiological Society
Secretary, Dr. Mario C. Gian, 610 Niagara St., Buffalo, N. Y. Meets second Monday evening each month, October to May inclusive.

Central New York Roentgen Ray Society
Secretary, Dr. Dwight V. Needham, 608 E. Genesee St., Syracuse, N. Y. Three meetings a year January, May, November.

Central Ohio Radiological Society
Secretary, Dr. Paul D. Meyer, Grant Hospital, Columbus, Ohio. Meets at 6:30 P.M. on second Thursday of October, December, February, April, and June at Seneca Hotel, Columbus, Ohio.

Chicago Roentgen Society
Secretary, Dr. John H. Gilmore, 720 N. Michigan Ave., Chicago 11, Ill. Meets second Thursday of each month October to April inclusive at the Palmer House.

Cincinnati Radiological Society
Secretary, Dr. Eugene L. Saenger, 735 Doctors Bldg., Cincinnati 2, Ohio. Meets last Monday of each month, September to May, inclusive.

Cleveland Radiological Society
Secretary, Dr. George L. Sackett, 10515 Carnegie Ave. Cleveland 6, Ohio. Meetings at 6:30 P.M. on fourth Monday of each month from October to April.

Dallas-Fort Worth Roentgen Study Club
Secretary, Dr. X. R. Hyde, Medical Arts Bldg., Fort Worth, Texas. Meets in Dallas on odd months and in Fort Worth on even months, on third Monday, 7:30 P.M.

Denver Radiological Club
Secretary, Dr. Mark S. Donovan, 306 Majestic Bldg., Denver 2, Colo. Meets third Friday of each month at Department of Radiology, Colorado School of Medicine.

Detroit Roentgen Ray and Radium Society
Secretary, Dr. E. R. Witwer, Harper Hospital. Meets monthly on first Thursday from October to May, at Wayne County Medical Society Building.

Florida Radiological Society
Secretary, Dr. F. K. Hurt, Riverside Hospital, Jacksonville, Fla. Meets twice annually, in the spring with the annual State Society meeting, and in the fall.

Georgia Radiological Society
Secretary, Dr. Robert Drane, DeRenne Apartments, Savannah, Ga. Meets in mid-winter and at annual meeting of Medical Association of Georgia in the spring.

Houston X-ray Club
Secretary, Dr. Curtis H. Burge, 3020 San Jacinto St., Houston 4, Texas. Meets fourth Monday each month.

Radiological Society of Kansas City
Secretary, Dr. Arthur B. Smith, 800 Argyle Bldg., Kansas City, Mo. Meets third Thursday of each month.

Illinois Radiological Society
Secretary, Dr. Wm. DeHollander, St. John's Hospital, Springfield, Ill. Meets three times a year.

Indiana Roentgen Society
Secretary, Dr. William M. Loehr, 712 Hume-Mansur Bldg., Indianapolis 4. Meets second Sunday in May.

Iowa X-Ray Club
Secretary, Dr. Arthur W. Erskine, 326 Higley Bldg., Cedar Rapids, Iowa. Luncheon and business meeting during annual session of Iowa State Medical Society. Special meetings by announcement.

Kansas Radiological Society
Secretary, Dr. Anthony F. Rossitto, Wichita Hospital, Wichita, Kansas. Meets annually with the State Medical Society.

Kentucky Radiological Society
Secretary, Dr. W. C. Martin, 321 W. Broadway, Louisville. Meets annually in Louisville on first Saturday in Apr.

Long Island Radiological Society
Secretary, Dr. Marcus Wiener, 1430-48th St., Brooklyn, N. Y. Meets Kings County Med. Soc. Bldg. monthly on fourth Thursday, October to May, 8:45 P.M.

Los Angeles Radiological Society
Secretary, Dr. Moris Horwitz, 441 No. Camden Drive, Beverly Hills, Calif. Meets second Wednesday each month at Los Angeles County Medical Assn. Building.

Louisiana Radiological Society
Secretary, Dr. J. R. Anderson, 1130 Louisiana Ave., Shreveport. Meets annually during Louisiana State Medical Society Meeting.

Louisville Radiological Society
Secretary, Dr. E. L. Pirkey, Louisville General Hospital, Louisville 2, Ky. Meets monthly on second Friday at Louisville General Hospital.

Michigan Association of Roentgenologists
Secretary, Dr. R. D. McDuff, 220 Genesee Bank Bldg., Flint 3, Mich.

Milwaukee Roentgen Ray Society
Secretary, Dr. C. A. H. Fortier, 231 W. Wisconsin Ave.,

* Secretaries of societies not here listed are requested to send the necessary information to the Editor.

Milwaukee, Wis. Meets monthly on second Monday at University Club.

Minnesota Radiological Society
Secretary, Dr. Chauncey N. Borman, 802 Medical Arts Bldg., Minneapolis 2, Minn. Two meetings yearly, one at time of Minnesota State Medical Association the other in the fall.

Nebraska Radiological Society
Secretary, Dr. Ralph C. Moore, Nebraska Methodist Hospital, Omaha 3, Nebr. Meets third Wednesday of each month, at 6 P.M. at either Omaha or Lincoln.

New England Roentgen Ray Society
Secretary, Dr. George Levene, Massachusetts Memorial Hospitals, Boston, Mass. Meets monthly on third Friday, Boston Medical Library.

New Hampshire Roentgen Ray Society
Secretary, Dr. A. C. Johnston, Elliott Community Hospital, Keene, N. H. Meets four to six times yearly.

New York Roentgen Society
Secretary, Dr. Ramsay Spillman, 115 East 61st St., New York City. Meets monthly on third Monday, New York Academy of Medicine, at 8:30 P.M.

North Carolina Radiological Society
Secretary, Dr. J. E. Hemphill, 323 Professional Bldg., Charlotte 2, N. C. Meets in May and October.

North Dakota Radiological Society
Secretary, Dr. C. O. Heilman, 807 Broadway, Fargo. Meetings held by announcement.

Northern California Radiological Club
Secretary, Dr. C. E. Grayson, Medico-Dental Bldg., Sacramento 14, Calif. Meets at dinner last Monday, every second month, except June, July and August. Next meeting Sept. 27, 1948.

Ohio State Radiological Society
Secretary, Dr. Carroll C. Dundon, 2065 Adelbert Road, Cleveland 6, Ohio.

Oklahoma State Radiological Society
Secretary, Dr. W. E. Brown, Tulsa, Okla. Three regular meetings annually.

Oregon Radiological Society
Secretary, Dr. William Y. Burton, 242 Medical Arts Bldg., Portland 5, Oregon. Meets monthly 2nd Wednesday, 8:00 P.M., Library of University of Oregon Medical School.

Orleans Parish Radiological Society
Secretary, Dr. Joseph V. Schlosser, Charity Hospital, New Orleans 13, La. Meets first Tuesday of each month.

Pacific Northwest Radiological Society
Secretary, Dr. S. J. Hawley, 1320 Madison St., Seattle 4, Wash. Meets annually in May.

Pacific Roentgen Society
Secretary, Dr. L. H. Garland, 450 Sutter St., San Francisco, Calif. Meets annually, during meeting of California Medical Association.

Pennsylvania Radiological Society
Secretary, Dr. J. M. Converse, 416 Pine St., Williamsport.

Philadelphia Roentgen Ray Society
Secretary, Dr. Arthur Finkelstein, Graduate Hospital, 19th and Lombard St. Meets first Thursday each month October to May, at 8:00 P.M., in Thomson Hall, College of Physicians.

Pittsburgh Roentgen Society
Secretary, Dr. R. P. Meader, 4002 Jenkins Arcade Pittsburgh 22, Pa. Meets 6:30 P.M. at Webster Hall Hotel on second Wednesday each month, October to May inclusive.

Queens Roentgen Ray Society
Secretary, Dr. J. E. Goldstein, 88-29 163rd St., Jamaica 3, N. Y. Meets fourth Monday of each month except during the summer.

Radiological Section, Baltimore Medical Society
Secretary, Dr. Harry A. Miller, 2452 Eutaw Place, Baltimore. Meets third Tuesday each month, September to May.

Radiological Section, Connecticut Medical Society
Secretary, Dr. Robert M. Lowman, Grace-New Haven Community Hospital, New Haven 11. Meets bimonthly second Thursday, at place selected by Secretary.

Radiological Section, District of Columbia Medical Society
Secretary, Dr. A. A. J. Den, 1801 K St., N. W., Washington, D. C. Meets Medical Society Auditorium, third Thursday, January, March, May, October at 8:00 P.M.

Radiological Section, Southern Medical Association
Secretary, Dr. Roy G. Giles, Temple, Texas.

Radiological Society of New Jersey
Secretary, Dr. Raphael Pomeranz, 31 Lincoln Park, Newark, N. J. Meets annually at time and place of State Medical Society. Mid-year meetings at place chosen by president.

Rochester Roentgen Ray Society, Rochester, N. Y.
Secretary, Dr. Murray P. George, Strong Memorial Hospital. Meets monthly on third Monday from October to May, inclusive, 8 P.M. at Strong Memorial Hospital.

Rocky Mountain Radiological Society
Secretary, Dr. Maurice D. Frazer, 1037 Stuart Bldg., Lincoln, Nebr.

St. Louis Society of Radiologists
Secretary, Dr. Edwin C. Ernst, Beaumont Medical Building, St. Louis, Mo. Meets fourth Wednesday of each month, except June, July, August, and September.

San Diego Roentgen Society
Secretary, Dr. R. F. Niehaus, 1831 Fourth Ave., San Diego, Calif. Meets monthly, first Wednesday at dinner.

Section on Radiology, California Medical Association
Secretary, Dr. D. R. MacColl, 2007 Wilshire Blvd., Los Angeles 5, Calif.

Section on Radiology, Illinois State Medical Society
Secretary, Dr. Edwin L. Rypins, 427 N. Main St., Bloomington, Ill.

Shreveport Radiological Club
Secretary, Dr. R. W. Cooper, Charity Hospital, Shreveport, La. Meets monthly on third Wednesday, at 7:30 P.M., September to May inclusive.

South Carolina X-Ray Society
Secretary, Dr. T. A. Pitts, Baptist Hospital, Columbia, S. C. Meets in Charleston on first Thursday in November, also at the time and place of South Carolina State Medical Association.

Tennessee Radiological Society
Secretary, Dr. J. M. Frère, 707 Walnut St., Chattanooga, Tenn. Meets annually at the time and place of the Tennessee State Medical Association.

Texas Radiological Society
Secretary, Dr. R. P. O'Bannon, 650 Fifth Ave., Fort Worth 4, Texas.

University of Michigan Department of Roentgenology Staff Meeting
Meets each Monday evening from September to June, at 7 P.M. at University Hospital.

University of Wisconsin Radiological Conference
Secretary, Dr. E. A. Pohle, 1300 University Ave., Madison, Wis. Meets first and third Thursdays 4:00 to 5:00 P.M., September to May inclusive. Room 203, Service Memorial Institute, 426 N. Charter St., Madison.

Utah Radiological Conference
Secretary, Dr. Henry H. Lerner, School of Medicine, University of Utah, Salt Lake City 1. Meets 1st and 3rd Thursdays monthly from 7:30 to 10 P.M., Salt Lake County General Hospital, September to June.

Utah State Radiological Society
Secretary, Dr. M. Lowry Allen, Judge Bldg., Salt Lake City 1, Utah. Meets third Wednesday in September, November, January, March and May.

Virginia Radiological Society
Secretary, Dr. P. B. Parsons, Norfolk General Hospital, Norfolk, Va. Meets annually in October.

Washington State Radiological Society
Secretary, Dr. Homer V. Hartzell, 310 Stimson Bldg., Seattle 1, Wash. Meets fourth Monday each month, October through May, College Club, Seattle.

X-Ray Study Club of San Francisco
Secretary, Dr. Ivan J. Miller, 49 Fourth St., San Francisco 3. Meets monthly on third Thursday at 7:45 P.M., January to June at Lane Hall, Stanford University Hospital, and July to December at Langley Porter Clinic, University of California Hospital.

Cuba

Sociedad de Radiología y Fisioterapia de Cuba
President, Dr. J. Manuel Viamonte, Hospital Mercedes, Habana, Cuba. Meets monthly in Habana.

Mexico

Sociedad Mexicana de Radiologia y Fisioterapia
General Secretary, Dr. D. P. Cossio, Marsella No. 11, Mexico, D. F. Meets first Monday of each month.

British Empire

British Institute of Radiology Incorporated with the Roentgen Society
Medical Members' meeting held monthly on third Friday at 2:30 p.m. and Ordinary Meeting at same time on following Saturday, October to May, 32 Welbeck St., London, W.1.

Faculty of Radiologists
Honorary Secretary, Dr. J. F. Bromley, 45, Lincoln's Inn Fields, London, W.C.2, England.

Section of Radiology of the Royal Society of Medicine (Confined to Medical Members)
Meets third Friday each month at 4:45 p.m. at the Royal Society of Medicine, 1 Wimpole St., London.

Canadian Association of Radiologists
Honorary Secretary, Dr. E. M. Crawford, 2100 Marlowe Ave., Montreal 28, Que. Meetings January and June.

Section of Radiology, Canadian Medical Association
Secretary, Dr. C. M. Jones, Inglis St., Ext. Halifax, N. S.

Société Canadienne-Francaise d'Electrologie et de Radiologie Médicales
Secretary, Dr. Origéne Dufresne, 4120 Ontario St., East, Montreal, P. Q.

Australian and New Zealand Association of Radiologists
Honorary Secretary, Dr. Alan R. Colwell, 135 Macquarie St., Sydney, N.S.W.
Honorary Secretaries, State Branches:
New South Wales, Dr. E. W. Frecker, 135 Macquarie St., Sydney.
Victoria, Dr. T. L. Tyrer, 3 Lockerbie Court, East St. Kilda.
Queensland, Dr. J. Adam, 131 Wickham Terrace, Brisbane.
South Australia, Dr. B. C. Smeaton, 178 North Terrace, Adelaide.
Western Australia, Dr. A. M. Nelson, 179-B St. Georges Terrace, Perth.
New Zealand, Dr. E. G. Lynch, 12 Bolton St., Wellington.

South America

Sociedad Argentina de Radiologia
Secretary, Dr. Guido Gotta, Buenos Aires, Argentina. Meetings are held monthly.

Sociedade Brasileira de Radiologia Medica
Secretary, Dr. Nicola Caminha, Av. Mem de Sa, Rio de Janeiro, Brazil. Meets monthly, except during January, February and March.

Sociedade Brasileira de Radioterapia
Secretary, Dr. Andrelino Amaral, Av. Brigadeiro Luiz Antonio, 644, São Paulo, Brazil. Meets monthly on second Tuesday at 9 p.m. in São Paulo at Av. Brigadeiro Luiz Antonio, 644.

Sociedad Peruana de Radiologia
Secretary, Dr. Julio Bedoya Paredes, Apartado, 2306, Lima, Peru. Meets monthly except during January, February and March, at Asociación Médica Peruana "Daniel A Carrión," Villalta, 218, Lima.

Sociedad de Radiologica, Cancerologia y Fisica Medica del Uruguay
Secretary, Dr. Arias Bellini.

Continental Europe

Société Belge de Radiologie
General Secretary, Dr. S. Masy, 111 Avenue des Alliés, Louvain, Belgium. Meets monthly, second Sunday at Maison des Médecins, Brussels.

Ceskoslovenská společnost pro röntgenologii a radiologii v Praze
Secretary, Dr. Roman Bláha, Praha XII, stát. nemocnice, Czechoslovakia. Meets monthly except during July, August, and September. Annual general meeting.

Polish Society of Radiology
Secretary, Dr. L. Zgliczynski, 59 Nowogrodzka St., Warsaw, Poland. Next meeting, Krakow, June 2 and 3, 1949.

Gdansk Section, Polish Society of Radiology
Secretary, Dr. A. Smigielska, Akademia Lekarska, Gdansk. Meets monthly last Sunday at 10.30, X-Ray Dept., Akademia Gdansk.

Warsaw Section, Polish Society of Radiology
Secretary, Dr. L. Zgliczynski, 59 Nowogrodzka St., Warsaw, Poland. Meets monthly.

Societatea Romana de Radiologie si Electrologie
Secretary, Dr. Oscar Meller, Str. Banual Mărăcine, 30, S. I., Bucuresti, Roumania. Meets second Monday in every month with the exception of July and August.

All-Russian Roentgen Ray Association, Leningrad. USSR in the State Institute of Roentgenology and Radiology, 6 Roentgen St.
Secretaries, Drs. S. A. Reinberg and S. G. Simonson. Meets annually.

Leningrad Roentgen Ray Society
Secretaries, Drs. S. G. Simonson and G. A. Gusterin. Meets monthly, first Monday at 8 o'clock, State Institute of Roentgenology and Radiology, Leningrad.

Moscow Roentgen Ray Society
Secretaries, Drs. L. L. Holst, A. W. Ssamygin and S. T. Konobejevsky. Meets monthly, first Monday, 8 p.m.

Scandinavian Roentgen Societies
The Scandinavian roentgen societies have formed a joint association called the Northern Association for Medical Radiology, meeting every second year in the different countries belonging to the Association.

Sociedad Espanola de Radiologia y Electrologia
Secretary, Dr. J. Martin-Crespo, Fuencarral, 7. Madrid, Spain. Meets monthly in Madrid.

Schweizerische Röntgen-Gesellschaft (Société Suisse de Radiologie)
President, Dr. H. E. Walther, Gloriastr. 14, Zürich, Switzerland.

Societa Italiana di Radiologia Medica
Secretary, Prof. Mario Ponzio, Ospedale Mauriziano Torino, Italy. Meets biannually.

SCIENTIFIC EXHIBIT

The Scientific Exhibit, as is the tradition, formed an interesting and very valuable part of the Forty-Ninth Annual Meeting of the American Roentgen Ray Society, which was held in Chicago, Illinois, September 14–17, 1948. President Reynolds and his Program Committee had arranged the schedule of the meeting in such a manner that ample time was given for the study of the exhibits. The Scientific Exhibits Committee, under the Chairmanship of Dr. Wilbur Bailey cooperated in this by furnishing space accommodation next to the assembly hall. The exhibitors themselves contributed to the success by giving generously of their valuable time in explaining the purport and detailed arrangement of their exhibits. The attractiveness of the display and the scientific interest of the subjects chosen as well as the timeliness of some of the atomic energy topics were stimulating and undoubtedly accounted for the popularity of the exhibits this year. The Committee on Awards expressed its thanks to the Surgeon General of the Navy, to the Surgeon General of the Army and to the Chief Medical Director of the Veterans Administration for the excellent exhibits from these services. The Committee awarded to the exhibits as indicated in the following description, the Silver Medal, the Bronze Medal and four Certificates of Merit.

One of the most interesting and instructive exhibits was that by Wendell G. Scott, M.D., and Sherwood Moore, M.D., Mallinckrodt Institute of Radiology and Washington University School of Medicine, St. Louis, Missouri, entitled "Automatization of Angiocardiography by the Tautograph." The exhibit was the description of equipment which was devised to automatize cardiovascular angiography and other related roentgenographic procedures. The purpose was to develop a system by which it would be possible to make repeated, short roentgenographic exposures using the Potter-Bucky diaphragm. The tautograph was demonstrated along with details of construction and of the electric circuits that are employed. The apparatus offers a new principle in rapid serial roentgenography by utilizing a chain conveyor system for standard cassettes, by the incorporation of a reciprocating Potter-Bucky grid and by a complete automatization of the entire equipment. Normal angiograms as well as some pathologic angiograms as, for example, cor biatriatum triloculare, Eisenmenger complex, etc., were used to illustrate the method. A cinematographic film was also projected showing the actual method of procedure. This exhibit was given a Certificate of Merit by the Committee on Awards.

"Renal Pathology" was the title of an exhibit by Cesare Gianturco, M.D., Carle Hospital Clinic, Urbana, Illinois. This exhibit consisted of air brush drawings showing typical roentgen aspects of various renal diseases. The purpose was to show the usefulness of air brush drawings in demonstrating roentgenologic pathology. Some of the illustrated cases were from the author's personal collection and others were reproduced from those published in the literature. An effort was made to abolish the unimportant details and to emphasize the characteristic features of each condition.

"The Time Factor in Cerebral Angiography: The Sanchez-Perez Automatic Cranial Seriograph" was the title of an exhibit by J. M. Sanchez-Perez, M.D. (by invitation), University of Southern California School of Medicine, Beverly Hills, California. The exhibit consisted of twenty-eight cerebral angiograms, selected from a series, and the Sanchez-Perez automatic cranial seriograph. Charts were included explaining the time factor in cerebral angiography. The apparatus has a magazine provided for six specially constructed cassettes of 10 by 12 inch size which are run automatically every $2\frac{1}{2}$ seconds with the slow speed and all six in $4\frac{1}{2}$ seconds with the fast speed, there being a synchronization with the timer. Each cassette is numbered from 1 to 6 with a lead number so that the sequence can be established after develop-

ment, and the position of the head can be recognized.

The regularity of the intervals gives in the resulting angiograms, not only the possible anatomical distortion or pathological condition but when the six roentgenograms are considered together they constitute a graphic representation of the physiological function of the circulation in the brain.

Another exhibit was entitled "Pneumarthrography of the Knee: An Aid in Internal Derangements" and was presented by W. H. McGraw, M.D., H. E. Snedden, M.D., J. W. Mulkley, M.D., and M. D. Sachs, M.D. (all by invitation), Crile Veterans Administration Hospital and Western Reserve University Medical School, Cleveland, Ohio. This exhibit, with its evaluation, was primarily designed to aid in the early and accurate diagnosis of the many conditions involving the knee joint. It was offered to illustrate the scope of the diagnostic value of pneumarthrography. The following subjects were included in the exhibit: (1) a short history of pneumarthrography; (2) special transparencies to illustrate the anatomy of the knee joint; (3) the methods of technique were outlined; (4) pneumarthrograms were shown with variations of the normal of internal structures of the knee; (5) illustrative cases were presented in detail; (6) an evaluation of pneumarthrography was included; (7) among the surgical advantages it was pointed out that few if any exploratory operations are necessary on the knee joint.

"Cancer Teaching Models Permitting Palpation" by Leonard B. Goldman, M.D., and Abram Belskie, F.N.S.S. (both by invitation), New York Medical College and Queens General Hospital, New York, New York, was a very interesting exhibit which consisted of life-sized, full-colored models of various parts and organs of the body demonstrating early cancer. These models may be palpated. The following were shown: 1. Mouth models with cancer in various locations. 2. Ear, nose and throat models demonstrating malignant lesions. 3. Breasts showing various tumors; a female bust demonstrating radical mastectomy. 4. Models of lungs. 5. Gynecological models demonstrating types of cancer of the cervix and fundus. 6. Radium insertion: To show radium needles in tongue, radium tandem in the uterus, and colpostat and corks in the vagina.

Lewis E. Etter M.D. (by invitation), Western State Psychiatric Institute and Clinic, Pittsburgh, Pennsylvania, presented an unusual exhibit entitled "New Method for Roentgen Anatomical Study of the Skull." This new method was developed by disarticulating normal skulls and making films of the separate bones and of the skull with and without the bone in question to illustrate clearly the components of each bone as seen on the roentgenogram in the various standard projections. The exhibit of the roentgenograms so made was prepared by cutting out the black background, mounting and labelling the silhouettes on cleared film. The illustrations included the components of the sphenoid, the maxillae, the frontal and ethmoid bone, the petrous pyramid, the sphenoid bone and optic canal showing the optic foramen position, the parietal bones, the occipital and the temporal bones. The roentgenograms of bones of the skull specimens were presented with and without the respective bone in various positions, such as posteroanterior view, lateral view, basal view, oblique view. Waters position, etc., so as to obtain roentgen images for guidance in the proper interpretation of routine roentgenograms and also to have examples for teaching. As a visual aid the method of cutting out the image in the roentgenogram from the black background and glueing this image to a cleared film gives one ample space for lettering the anatomical features directly. Examples of normal skulls with pneumoencephalograms were included to illustrate this point. The final film with the image on is mounted between two sheets of plexiglass. This exhibit was awarded a Certificate of Merit.

An extremely interesting exhibit was presented from the University of Chicago

and Argonne National Laboratory, Chicago Illinois, by James Crosbie, M.D., Burton Grossman, B.S., Charles L. McKeen, B. S., Richard Elghammer, B. S., and J. Garrott Allen, M.D. (all by invitation), entitled "Irradiation Hemorrhage: Heparinemia(?)." This exhibit showed evidence that hemorrhagic aspects of total body irradiation may be due to the release of heparin and that such hemorrhage can be largely controlled by the administration of protamine sulfate or toluidine blue. The role of the heparin like substance in the bleeding tendency can best be determined by measuring the in vitro tolerance of the blood to heparin. The sources of heparin and its extraction from animal tissue and its purification were illustrated stating that heparin has never been synthesized in the laboratory. The reactions of heparin with toluidine blue were demonstrated. Heparin forms metachromatic purple color with toluidine blue. Its anticoagulant effects are neutralized by toluidine blue. The reactions with protamine sulfate were also indicated.

Examples were given showing that dogs exposed to lethal doses (450 r) of roentgen radiation developed progressive leukopenia, anemia and thrombocytopenia with prolongation of clotting and bleeding time leading to hemorrhage. This hemorrhage is well controlled by protamine sulfate or toluidine blue although the life is only slightly prolonged. A decreased heparin tolerance and control of hemorrhage with antiheparin therapy has been noted in (1) acute leukemia; (2) hemophilia; (3) irradiation injury; (4) hemorrhage complicating nitrogen mustard therapy. In idiopathic thrombocytic purpura the heparin tolerance may be normal or decreased. Response to antiheparin therapy is variable and usually incomplete. No response to antiheparin therapy has been observed in hemophilia or the prothrombin deficiencies. The heparin tolerance test serves to determine the ability of protamine sulfate to coagulate heparinized normal blood. The blood tolerance for heparin can be measured by a simple titration procedure. For the therapy one can use protamine sulfate intravenously or intramuscularly as a 1 per cent solution in doses of 0.5 to 3.5 mg. per kg. of body weight two to three times daily or toluidine blue intravenously in doses of 0.5 to 3.5 mg. per kg. body weight in 250 to 500 cc. normal saline once a day or every second day. This exhibit was awarded the Silver Medal, the highest award in this year's Scientific Exhibit.

An interesting exhibit was presented by Lee A. Hadley, M.D. (by invitation), Syracuse, New York, entitled "Intervertebral Foramen Studies." The exhibit consisted of specimens showing normal and abnormal intervertebral foramina mounted in transparent plastic together with the roentgenogram and stained sections from the specimen. The purpose of the exhibit was to show different ways in which the intervertebral foramen may become constricted, limiting the reserve cushion space; and to demonstrate by cadaver material actual compression and distortion of the nerve root by herniation of disc substance backward into the intervertebral foramen.

At the movable intervertebral foramen, there is a generous cushion space about the nerve, the latter being only about one-fifth the diameter of the opening. Restriction of this reserve cushion space results from foramen encroachment, predisposing to nerve root pressure. The foramen is relatively smaller compared to the nerve root than is the lower spinal canal as compared to the cauda equina.

Roentgenograms of patients showed different types of foramen encroachment: (1) physiologic; (2) traumatic; (3) degeneration of intervertebral disc with (a) spur formation backward from the disc margin, (b) spur formation forward from the posterior articulation, (c) pedicles coming closer together, (d) subluxation with telescoping of the posterior articulation forward into the foramen and wedging forward of the underlying body and (e) hyperplasia of the posterior capsule or ligamentum flavum; (4) disc substance bulging backward into the foramen causing nerve

root pressure. In certain cases the nerve root is actually compressed by herniation of disc substance backward into the foramen. Patients operated upon for symptoms of nerve root pressure ("herniated nucleus pulposus," "ruptured disc") must have their intervertebral foramen investigated. It is not sufficient just to explore the spinal canal. Decompression of this vulnerable opening may be necessary.

The exhibit entitled "Medicine at Operation Crossroads" presented by the Navy Department, Bureau of Medicine and Surgery (by invitation), Washington, D.C., was a beautifully worked up exhibit and attracted much attention. The exhibit was divided into three sections. The first section, the Naval Medical Research Section, demonstrated research projects in radiation injuries at Bikini. Numerous photographs illustrated the disposition of the animals and the arrangement of the laboratories on the U.S.S. *Burleson*. The hematologic changes as well as specimens of organs showing the gross pathologic changes in various animals were given and the effects were compared with those following exposure to total body 1,000 kv. roentgen irradiation. The outstanding acute changes were ulceration of the various organs, associated with severe blood changes and anemia and other infections. This section also illustrated the effects on the survivors of the Bikini test. Samples of materials from military clothing were exhibited exposed to atomic bombing on target ships. Two goats, one being Angora goat No. 135, "Satan," and the other an Alpine goat, No. 156, were a part of the exhibit for a short time. These goats were exposed on target ships. Physical examination following the test explosion revealed no frank injury. Laboratory studies indicated subclinical ionizing radiation effects. The later clinical course was characteristic of sublethal ionizing radiation injury. The goats received transfusions (200 to 400 cc.) daily for thirty days following the atomic blast and on alternate days thereafter for thirty days; also penicillin (2,500,000 units) daily for ninety days following the blast. Both goats showed complete recovery and at present are in excellent health.

The second section, which was the Radiological Safety Section, illustrated the preventive measures instituted against radioactive hazards peculiar to the atomic bomb which enabled the Task Force personnel to return safely to the target area as rapidly as possible. Radiation hazards resulting from detonation of the atomic bomb were: (1) external radiation hazards (a) instantaneous—heat, neutrons and gamma radiation; (b) residual—fission products deposited by atomic cloud emit beta and gamma rays; and (2) internal radiation hazards (a) absorbed fission products by lungs and skin abrasions (b) ingested fission products in food and water.

The third section was the Damage Control Safety Section. This included illustrations for the training of safety officers and boarding teams which were specially indoctrinated in safety and damage control incident to the hazardous initial boarding operations. Their mission was successfully completed without injury. The various apparatus and instruments, equipment and type of uniform used were exhibited. Animated illustrations showed the surface explosions and the methods used for entering Bikini.

The "Veterans Administration Radiological Section Information Booth" (by invitation), Washington, D. C., showed various architectural schemes for proposed 500 bed general, medical and surgical hospitals, 1,000 bed surgical hospitals, and 1,000 bed general medical hospitals. Someone connected with the Veterans Administration was always at the booth to give information to those interested.

"Anomalies of the Aortic Arch and Its Branches" was the title of an exhibit by Jesse E. Edwards, M.D. (by invitation), Mayo Clinic, Rochester, Minnesota. The exhibit showed by color drawings the anatomy of and the developmental basis for the anomalies of the aortic arch system which may interfere with the function of

the trachea and the esophagus. In the first two rows were illustrated a group of anomalies of the aortic arch and its branches called Group 1. One feature that each member of this group has is that the ductus arteriosus and the descending aorta are in essentially normal positions. The ductus arteriosus is the left-sided structure and the descending aorta lies in the left side of the thorax.

The various configurations of the members of Group 1 may be considered modifications of the aortic arch anomaly known as functioning double aortic arch. As a result of narrowing, atresia or disappearance of certain segments of the functioning double aortic arch, the configurations shown are obtained.

In the third and fourth rows were shown anomalies of Group 11. These are essentially mirror images of respective members of Group 1 because they are characterized by the presence of a right-sided ductus arteriosus and by the presence of the upper portion of the descending aorta in the right side of the thorax. In the lower part of the thorax, the aorta crosses the midline to emerge from the thorax through the aortic hiatus of the diaphragm.

As in Group 1 the modified structure is the functioning double aortic arch, from which by narrowing, atresia or disappearance of certain portion of the double arch, the various members of Group 11 are derived. Group 11 is by far smaller than Group 1. Some of the patterns shown have not as yet been encountered.

An exhibit entitled "Cancer Cells in Sputum and Bronchial Secretions: An Aid in Diagnosis of Bronchogenic Carcinoma" was presented by Lewis B. Woolner, M.D., and John R. McDonald, M.D. (both by invitation), Mayo Clinic, Rochester, Minnesota. This exhibit showed the clinical value of cytologic examination of sputum and bronchial secretions as an aid in diagnosis of bronchogenic carcinoma. It included: (1) the technique of collection of material and the fixation and staining of the smears; (2) the cytology of normal sputum; (3) the demonstration of cancer cells in sputum, and in bronchial secretions originating from the various histopathologic types of carcinoma of the lung; (4) case histories including roentgen findings, results of bronchoscopy, cytologic studies and the findings at surgery or necropsy illustrating the diagnostic value of this method; (5) an analysis of the data on 200 consecutive cases in which the sputum or bronchial secretions were positive for carcinoma cells. Beautiful color photomicrographs, kodachrome photographs, roentgenograms, and color photographs of the gross specimen illustrated each case.

Another exhibit dealing with malignant disease was "The Role of Nitrogen Mustard as an Adjunct to Radiation Therapy of Malignant Diseases; A Clinical Study of 75 Cases" by Bernard Roswit, M.D., and Gustave Kaplan, M.D. (both by invitation), U. S. Veterans Hospital, Bronx, New York. At present there is keen and widespread interest among radiologists and internists alike in the new nitrogen mustard drugs for the therapy of malignant diseases. In this exhibit was presented the authors' experience with HN2 (methyl-bis(beta-chlorethyl)amine hydrochloride) as an adjunct to radiation therapy in 75 cases of Hodgkin's disease, lymphosarcoma, leukemia, bronchogenic carcinoma and a variety of other malignant disorders. The clinical research began in January, 1947, in collaboration with the Committee on Growth of the National Research Council, and included serial studies of bone marrow, peripheral blood, lymph nodes and postmortem material. The authors are convinced from these studies that HN2 is of value only as an adjunct to irradiation, in those cases of Hodgkin's disease, lymphosarcoma and leukemia which are generalized, advanced or radioresistant. HN2 should not be employed in early or radiosensitive cases. In patients with inoperable bronchogenic carcinoma HN2 has been of some value. A large variety of other advanced, inoperable malignant disorders did not benefit from HN2. The important

complications are leukopenia, aplastic anemia and thrombocytopenia. Charts were given showing clinical study, chemistry, indications, contraindications, pharmacodynamics, technique, toxic reactions, clinical material, results and conclusions. In one panel representative clinical cases were illustrated. Roentgenograms, photomicrographs and photographs were shown.

Another exhibit from the Argonne National Laboratory and the University of Chicago, Department of Medicine, Chicago, Illinois, was "The Effect of Induced Anemia on Radiation Damage" by Leon O. Jacobson, M.D., Matthew H. Block, Ph.D., M.D., E. K. Marks, Ph.D., E. O. Gaston, Ph.D., and E. L. Simmons, Ph.D. (all by invitation). It was shown graphically that normal rabbits given a median lethal dose of roentgen radiation (800 r total body), develop an anemia reaching its maximum fourteen days after exposure; whereas, animals that are already anemic by virtue of the phenylhydrazine administration or phlebotomies develop no further anemia after exposure to the median lethal dose of roentgen radiation. Photomicrographic illustrations were presented which demonstrated that this difference in effect is due to the virtually complete destruction of erythrocyte precursors in the normal animal after irradiation, whereas in animals already anemic before irradiation, a sufficient number of erythrocyte precursors survive the irradiation to insure a normal production of erythrocytes.

An interesting exhibit entitled "Deformities of the Bladder Secondary to Ureteral Stone" was presented by Bernard Hall, M.D. (by invitation), Leo G. Rigler, M.D., and Harold O. Peterson, M.D., St. Paul and Minneapolis, Minnesota. Deformity of the bladder as a result of edema and injection of the bladder wall caused by a ureteral stone is a fairly common finding. The ureteral stone must be located in the intramural part of the ureter to produce these changes. The deformity observed on roentgenograms varies from extremely minimal findings to gross changes resembling a primary carcinoma of the bladder. All of these findings have long been recognized by the urologist during cystoscopic examinations, but have too often escaped notice by roentgenologists. They were exhibited by diagrams and roentgenograms and the significance of recognizing the deformity was pointed out.

An exhibit entitled "A Seriograph for Intracranial Angiography" was presented by Solomon Fineman, M.D., Montefiore Hospital, New York, New York. The exhibit consisted of (1) a practical and inexpensive apparatus designed to serve as a combination seriograph, table and stretcher, for intracranial angiography; (2) the construction of the apparatus makes possible lateral and anteroposterior angiography without changing the patient's position on the seriographic table; (3) a simple mechanism for rapid change of cassettes makes it possible to obtain an arteriogram, capillarogram and venogram during a single injection of 10 to 15 cc. of diodrast; (4) arteriograms, capillarograms and venograms obtained with the use of the apparatus as well as the advantage to be gained from three phase angiography in the diagnosis of cerebral tumors were illustrated.

An exhibit on "A Photofluorographic Method for Angiocardiography" was presented by Harold L. Temple, M.D., Israel Steinberg, M.D., and Charles T. Dotter, M.D. (all by invitation), New York Hospital, Cornell Medical Center, New York, New York. Angiocardiography as described in 1938 by Robb and Steinberg was carried out employing a photofluorographic camera designed to shift automatically 70 mm. film strips, rapidly exposing successive frames. This equipment which makes use of the relay system and a Fairchild camera was constructed by the General Electric Company. Illustration of the method and results comprised this exhibit. The 70 mm. films can be read with almost as accurate results as the 14 by 17 inch standard films.

Another exhibit dealing with the heart

was "The Integrated Examination of the Congenital Cardiac" by the Cardiovascular Research Group (by invitation), The Mount Sinai Hospital, New York, New York. The exhibit included case histories of congenital cardiacs to show how an integrated examination permits of accurate anatomical and physiological diagnosis. The data illustrated the detailed case history, clinical examination, angiocardiogram, electrocardiogram, phonocardiogram, result of intracardiac catheterization, arterial and venous pulse tracings, electrokymogram and finger plethysmogram.

"The Early Detection of Gastrointestinal Lesions by Photofluorography" was the title of an exhibit by John F. Roach, M.D. (by invitation), Robert D. Sloan, M.D. (by invitation), and Russell H. Morgan, M.D., Department of Radiology, Johns Hopkins Hospital, Baltimore, Maryland. The exhibit illustrated the experimental findings of a study currently in progress at the Johns Hopkins Hospital to explore the application of mass roentgenographic methods to the early diagnosis of gastric cancer.

Another interesting exhibit on the intestinal tract was entitled "A Rapid Method of Roentgenologic Examination of the Small Intestine" by Sydney Weintraub, M.D., and Robert G. Williams, M.D. (both by invitation), New York Hospital, Cornell Medical College, New York, New York. The exhibit consisted of transparent copies of roentgenograms demonstrating the appearance of the small intestine in normal and pathological cases with use of the rapid method. The technique was explained on a panel, and a brief summary of results obtained with this method in normal and pathological cases filled a second panel. The remainder of the panels showed illustrative normal and pathological cases, including cases of regional enteritis, "deficiency pattern," sprue and small intestinal tumors. The method, briefly, is as follows: A barium-normal saline mixture is used as the contrast medium followed by 8 ounces of ice cold normal saline immediately and a second 8 ounces of ice cold normal saline five minutes after initial roentgenoscopic and film examination of the upper gastrointestinal tract. Abdominal roentgenograms are taken at five, fifteen and thirty minutes after the drinking of the first 8 ounces of ice cold normal saline. Roentgenograms are shown "wet" to the roentgenologist who will roentgenoscope and take spot films of suspicious areas. If the head of the meal has not yet reached the cecum, further films are taken at one-half or one hour intervals until it has.

"Tumors of the Kidney" was a beautifully prepared exhibit presented by Robert A. MacArthur, M.D., D.Sc., and H. C. Tellman, M.D. (both by invitation), Harper Hospital, Detroit, Michigan. The title was used in the broad sense of the word as cysts and polycystic kidney disease were also considered. The exhibit consisted of about 200 transparencies of roentgenograms, pyelograms and photographs of gross specimens, many of which were colored. The series included 16 cases of polycystic kidneys, 12 cases of solitary cysts, 1 case of hemorrhagic cyst, 10 cases of pelvic neoplasms, 1 case of pelvic hemangioma, 16 cases of parenchymal neoplasms in adults and 6 cases of Wilms' tumor. In discussing the differential diagnosis another 25 cases were presented because their pyelograms simulated renal tumors. In this series there were cases of pyonephrosis, solitary renal abscess, hydronephrosis, carbuncle of the kidney, renal tuberculosis, multiple cysts of the kidney, double kidney with pyonephrosis of the upper kidney, actinomycosis of the kidney, non-opaque calculus of the renal pelvis, massive renal infarction, intracapsular rupture of the kidney, extracapsular rupture of the kidney, calcified pyonephrosis, calcified spleen, splenomegalia, carcinoma of the pancreas, carcinoma of the adrenal gland, extrarenal angiosarcoma with teratoid growth distorting pyelographic pattern, abdominal aneurism, and Hodgkin's disease of the peri-ureteral glands. Finally a group of 4 rare lesions was displayed.

These were: (1) actinomycosis of the kidney; (2) large solitary cyst of the kidney in an infant four and a half months of age; (3) a case of Wilms' tumor living and well four and a half years following nephrectomy and postoperative irradiation, and (4) a case with 4 primary tumors, including a bladder tumor and a tumor of the renal pelvis. This exhibit represented an unusual wealth of clinical material and was awarded a Certificate of Merit.

"Hemosiderosis of the Lung Due to Mitral Heart Disease" was the title of an exhibit by Eugene P. Pendergrass, M.D., Edwin L. Lame, M.D. (by invitation), and Herman W. Ostrum, M.D. (by invitation), Hospital of the University of Pennsylvania, the Philadelphia General Hospital and the Presbyterian Hospital, Philadelphia, Pennsylvania. This exhibit dealt with mitral valve disease accompanied by the deposition of hemosiderin in the lungs in such fashion that roentgenograms reveal a fine nodulation much like pneumoconiosis or miliary tuberculosis. The condition is very rare. Three samples of exogenous siderosis are: arc-welding, inhaling of iron ladened fumes by silver finishers working in rouge (iron oxide) and grinding of ferrous metal. Endogenous pulmonary siderosis is exemplified by the presented cases of mitral heart disease and by the children who suffer severe anemias and die with hemosiderin nodules in the lungs. Reproductions were shown of roentgenograms of the lungs on 4 autopsied and 2 living cases of pulmonary hemosiderosis secondary to rheumatic mitral valve disease. Microscopic study on the 4 autopsied cases showed that collections of hemosiderin caused the discrete nodular pulmonary lesions seen in the roentgenograms. Such cases are of interest especially in differentiation from pneumoconiosis, miliary tuberculosis and a host of other nodular discrete pulmonary lesions. The excellence of this exhibit won the Bronze Medal, the second highest award given in the Scientific Exhibit.

Orrin S. Cook, M.D., and Wallace M. Roy, M.D., Sacramento, California, presented an exhibit entitled "Body Section Roentgenography of the Facial Bones and Cervical Spine." The value of body section roentgenography in demonstrating anomalies, fractures and other lesions involving the facial bones and cervical spine was shown. Its routine use for roentgenography of the odontoid process of the atlas was suggested.

An exhibit which came in too late for inclusion in the program was entitled "A Non-typical Collection of Free Exudative Fluid in the Diaphragmatic Part of the Pleural Cavity" by Apostalos Yiannacopoulos, M.D., University of Athens, Athens, Greece. The exhibit included three cases illustrating an uplift of the diaphragmatic dome which in fact constitutes a false uplift (pseudo-anosis) due to the collection of free fluid in the diaphragmatic part of the pleural cavity. In these cases it is believed that the pressure on the bronchial tree which leads to the pulmonary base by infiltrated glands results in an imperfect expansion of the corresponding part of the lung. Thus an increased negative pressure is produced in the diaphragmatic part of the pleural cavity and the free exudative fluid is collected there preferably.

An interesting exhibit from the Children's City Hospital, Havana, Cuba, by Agustin Castellano, M.D., and Raul Pereiras, M.D. (both by invitation), was entitled "Angiocardiography, Anatomo-roentgenologic Form of the Transposition of the Large Vessels." The demonstration of the cardiac silhouette is of no value in the diagnosis of the different varieties of transposition of the large vessels. This exhibit illustrated that angiocardiography permits it to be known from which cavity emerge the large vessels as well as their direction and diameter. On the basis of this it is possible to diagnose four anatomo-roentgenologic types of angiocardiograms which are of practical importance. These four types were illustrated with diagrams, standard roentgenograms and angiocardiograms taken in various views.

"Portable Roentgen Film Projector"

was the title of an exhibit by Raymond A. Dillon, M.D., and William P. Murphy, Jr., M.D. (both by invitation), Boston, Massachusetts. An optical apparatus designed and constructed by the exhibitors for the projection of original roentgenograms onto a large screen before a large or small audience was demonstrated. Wall charts showed the theory of operation and the construction detail. This exhibit was awarded a Certificate of Merit.

From the Isotopes Division, Atomic Energy Commission, Oak Ridge, Tennessee, was an exhibit prepared by Paul C. Aebersold, Ph.D., W. G. Morgan, M.D., and Bernard G. Saunders (all by invitation) and entitled "Isotopes for Radiology." The procedure for obtaining radioisotopes for therapy and medical research was presented in visual form. Charts and diagrams portrayed several therapeutic applications of radioisotopes. The health physics aspects of radioisotopes usage was illustrated by photographs of monitoring procedures and hood and laboratory design. Typical instruments used in health physics instrumentation completed the exhibit.

TECHNICAL EXHIBIT

In the previous pages of this issue are given accounts of the various activities connected with the Forty-ninth Annual Meeting of the American Roentgen Ray Society held in Chicago, September 14 to 17, 1948. The merits of the scientific sessions and the papers have been discussed and a description given of the Scientific Exhibits. However no report of this meeting would be complete without adequate mention of the Technical Exhibit. Each year has seen a continued increase in the number of technical exhibitors and in the size of the total exhibit. Along with this physical increase in size has gone an added attractiveness of display of the exhibits as well as an advance in engineering designs. The exhibit this year outdistanced all previous exhibits in all of these phases. As to the mere size of the exhibit a comparison with 1947 is interesting: In 1947, twenty-nine manufacturers reserved a total of sixty-one booths and 236 technical exhibitors were registered at the meeting; in 1948, thirty-six manufacturers reserved a total of seventy booths and 378 technical exhibitors were registered. As to the remaining features of the exhibit, each manufacturer had put forth great effort to make his display an outstanding one and there were many new types of apparatus shown and many new designs of equipment. The resulting exhibit, therefore, was one which was both attractive and functional. That the radiologists were aware and appreciative of this was evidenced by the fact that the exhibits were unusually well attended, not only, as would be expected, during the periods set aside in the scientific program for their viewing but also at all other hours of the day. The Society wishes to extend its thanks to the Technical Exhibitors for their large share in making the Forty-ninth Annual Meeting the success it was.

The following firms were represented in the Technical Exhibit: *Ansco*, Binghamton, N. Y.; *George W. Borg Corporation, Gibbs Division*, Delavan, Wis.; *Buck X-Ograph Company*, St. Louis, Mo.; *Canadian Radium and Uranium Corporation*, New York, N. Y.; *E. I. duPont de Nemours and Company*, Wilmington, Del.; *Eastman Kodak Company*, Rochester, N. Y.; *Eldorado Mining and Refining, Ltd.*, Ottawa, Ontario; *El-Tronics, Inc.*, Philadelphia, Pa.; *Eureka X-Ray Tube Corporation*, Chicago, Ill.; *Fairchild Camera and Instrument Corporation*, Jamaica, N. Y.; *General Electric X-Ray Corporation*, Milwaukee, Wis.; *Paul B. Hoeber*, New York, N. Y.; *Kelley-Koett Manufacturing Co.*, Covington, Kentucky; *Lea & Febiger*, Philadelphia, Pa.; *Liberty Dressing Company*, Gloversville, N. Y.; *Liebel-Flarsheim Company*, Cincinnati, Ohio; *Machlett Laboratories*, Springdale, Conn.; *F. Mattern Manufacturing Company*, Chicago, Ill.; *Medical Bureau*, Chicago, Ill.; *Wm. Meyer Company*, Chicago, Ill.; *Micro-equipment Corporation*, Chicago,

Ill.; *North American Philips Company*, New York, N. Y.; *Picker X-Ray Corporation*, New York, N. Y.; *Poole and Parker, Inc.*, Tulsa, Okla.; *Radium Chemical Company*, New York, N. Y.; *Schering Corporation*, Bloomfield, N. J.; *Frank Scholz X-Ray Engineering Service*, Boston, Mass.; *Standard X-Ray Company*, Chicago, Ill., *Charles C Thomas, Publisher*, Springfield, Ill.; *Universal X-Ray Products*, Chicago, Ill.; *Victoreen Instrument Com-Company*, Cleveland, Ohio; *Westinghouse Electric Corporation*, Pittsburgh, Pa.; *Winthrop-Stearns*, New York, N. Y.; *Wright Engineering Company*, Mountain Lakes, N. J.; *Year Book Publishers*, Chicago, Ill.

NEW OFFICERS

At the Forty-ninth Annual Meeting of the American Roentgen Ray Society held at the Palmer House, Chicago, Illinois, September 14–17, 1948, the following officers were elected for the year 1948–1949: *President-Elect:* U. V. Portmann, Cleveland, Ohio; *1st Vice-President:* Charles M. Richards, San Jose, California; *2nd Vice-President:* Earl E. Barth, Chicago, Illinois; *Secretary:* H. Dabney Kerr, Iowa City, Iowa (re-elected); *Treasurer:* Wendell G. Scott, St. Louis, Missouri (re-elected); *Member of the Executive Council:* Paul A. Bishop, Philadelphia, Pennsylvania; *Historian:* Ramsay Spillman, New York, New York (re-elected). The *President* is Lawrence Reynolds, Detroit, Michigan, and the *Chairman of the Executive Council* is Hugh F. Hare, Boston, Massachusetts.

FIFTIETH ANNUAL MEETING

It was announced in the July, 1948, issue of the JOURNAL that the Fiftieth Annual Meeting of the American Roentgen Ray Society would be held in San Francisco, California, September 6–9, 1949. At the recent meeting of the Society in Chicago it was decided that for a number of reasons the meeting place should be changed. The Society has been released from its reservation in San Francisco and the Fiftieth Annual Meeting of the American Roentgen Ray Society will be held at the Netherland Plaza Hotel, Cincinnati, Ohio, October 4, 5, 6 and 7, 1949.

THE THIRD INTER-AMERICAN CONGRESS OF RADIOLOGY

The Third Inter-American Congress of Radiology will assemble in Santiago, Chile, Friday, November 11, 1949, to Thursday, November 17, 1949, both dates included.

The Chilean Radiological Society has appointed as President, Dr. Felix J. Daza; as General Secretary for Latin-America, Dr. Santiago H. Calderón; as General Secretary for the United States and Canada, Dr. César A. Velasco; as General Treasurer, Dr. Alberto H. Ricci.

Participants in the Third Inter-American Congress of Radiology will be classified as follows: *Honorary members*—those appointed by the Chilean Radiological Society; *Titular members*—those radiologists who apply and are accredited by their respective societies; *Associate members*—those physicians who are not specialists in radiology, technicians, experts, manufacturers of electromedical equipment, and others who may apply, the latter being limited to three for each titular member.

James T. Case, M.D., 55 East Washington Street, Chicago 2, Illinois, has been delegated as regional secretary for the United States.

The Committee on International Affairs of the American College of Radiology, consisting of Ross Golden, M.D., Hugh F. Hare, M.D., Maurice Lenz, M.D., Charles L. Martin, M.D., Frazier J. Payton, M.D., Juan A. del Regato, M.D., M. C. Sosman, M.D., Calvin L. Stewart, M.D., and James T. Case, M.D., has been designated by the American College of Radiology, the American Radium Society, the American Roentgen Ray Society, and the Radiological Society of North America as their official committee of arrangements.

Application for membership in the Congress should be made at the earliest possi-

ble date, so that the Chilean Organizing Committee may have an adequate estimate of the extent of the preparations they need to make. The membership fee of twenty dollars should accompany the application.

The official languages will be Spanish, Portuguese, English and French. We are informed that provision will be made whereby earphones will be available for all who desire them, so that addresses given in Spanish may be heard simultaneously in English, or vice versa. This means, of course, that those members wishing to offer English contributions to this Congress, will arrange to have them translated into Spanish here or else get them into the hands of the regional secretary to be forwarded to the Congress headquarters in Santiago, Chile, sufficiently in advance of the meeting to permit time for translation.

The official subjects for consideration at the Congress will be the following:

A. "Radiological Exploration of the Cardiovascular System with Opaque Material."
B. "Diagnosis and Simple Radiological Exploration of the Skull," which has been subdivided into
   1—a) "Skull in General."
   b) "Sella Turcica."
   2—c) "Orbits."
   d) "Paranasal Cavities."
   3—e) "Temporal Bone."
C. "Radiation Treatment of Cancer of the Tongue."
D. "Radiation Treatment of Cancer of the Cervix."

The last two subjects will consist essentially of the following:

(1) Technique of radiotherapy.
(2) Immediate and subsequent reactions.
(3) Case reports illustrating degree and histological type of cancer.

The official speakers will be named by the Executive Committee after duly considering the recommendations from the committee of each country. The official speaker may present one or more co-lecturers.

Prospective members from the United States who wish to participate in any of the discussions outlined above should communicate with Dr. Case at the earliest convenience, so that the American committee will be able to adjust the discussions to the program by conference with the Program Committee in Santiago.

In addition to these official presentations, there will be time set apart for free subjects not related to the official themes. These may be presented only in the scientific exhibits in order to give them more objectivity. The free subjects will be presented as exhibits with comments.

The Inter-American College of Radiology was organized at the close of the Second Inter-American Congress of Radiology in Havana, Cuba, November, 1946. A convocation of this College will be held in connection with the Congress. Information concerning this College and applications blanks for Fellowship in the College may be obtained from Dr. Case. However, membership in the Third Inter-American Congress of Radiology is independent and not contingent upon fellowship in the College.

The more than three hundred Americans who made up the attendance from the United States at the Second Inter-American Congress of Radiology in Havana, have very pleasant memories of the meeting and many of them will wish to go to the meeting in Santiago in 1949.

The month of November is probably the most favorable time of the year from the standpoint of the weather. It should be borne in mind that the seasons are reversed, our winter being the summer of our South American friends. Excursions are contemplated to the southern part of Chile, especially the lake region, which is very beautiful and which offers opportunities for fishing and skiing, even in the summer months (corresponding to our winters here in the United States).

There is talk of arranging parties for air and sea travel, including a tour of some of the chief cities of South America. Travel-

ling by air, a very reasonable tour of the principal cities of South America and attendance on the full period of the Congress could be accomplished in about twenty days. Our Latin-American colleagues will give generously of their time in facilitating visits to the principal radiological institutions of each large city visited in the course of such a tour.

Further notices will be published from time to time. If any are anticipating, even faintly, possible attendance at this meeting, it is requested they communicate with Dr. Case as soon as possible. Every endeavor will be made to supply information.

Address all communications to the Chairman of the Committee, Dr. James T. Case, 55 East Washington Street, Chicago 2, Illinois.

COURSES IN RADIOISOTOPES

The Oak Ridge Institute of Nuclear Studies announces that four additional radioisotope courses have been scheduled for the fall and winter months. The additional courses are being offered in view of the fact that more than 300 qualified individuals applied for entrance to one of the three courses held during the summer months. There were only 96 places in these three courses.

Dates for the new courses and the fields of interest which will have priority follow:

October 25, 1948.....Industrial personnel
January 3, 1949.....Government personnel
February 14, 1949.....Medical personnel
March 14, 1949.....General

The Committee on Applications, which is comprised of representatives of the Oak Ridge Institute, and the Isotopes Division and the Division of Biology and Medicine of the Atomic Energy Commission, is now accepting applications for the courses. Additional information and application blanks may be obtained from Dr. Ralph T. Overman, Head, Special Training Division, Oak Ridge Institute of Nuclear Studies, P. O. Box 117, Oak Ridge, Tennessee. Individuals interested in attending one of the courses should apply as soon as possible.

Thirty-two participants will be accepted in each of the courses. Each four-weeks course will be divided into laboratory work, lecturers on laboratory experiments, general background lectures, and special-topic seminars. In order to give participants a maximum of knowledge and ability in the handling of radioactive isotopes in research work, experiments will be conducted covering the use and calibration of instruments, and the purification and separation of radioactive materials from inert materials and from other radioactive materials. Other lectures and experiments will illustrate the application of radioisotope techniques.

Mondays, Wednesdays, and Fridays will be devoted to laboratory work, while Tuesdays and Thursdays will be reserved for lectures. Ample time will be allowed for library work and consultation with instructors concerning individual problems. Participants are requested to bring plans of their laboratories, including lay-out, equipment, dimensions and similar information. The radioisotope staff will be available for consultation in connection with efficient organization of the laboratory for radioisotope work.

The courses include several seminars to be conducted by specialists in the various fields of interest. Typical seminars are:

Use of Radioisotopes in Animal Experimentation
Use of Radioisotopes in Plant Experimentation
Use of Radioisotopes in Humans
Principles and Practices of Health-Physics in Radioisotope Work
Design of Radiochemical Laboratories
Dosimetry
Instrumentation for Radioisotope Work
Scope of the Use of Radioisotope Techniques

The courses will be held in the laboratories and classrooms of the Oak Ridge Institute Building in Oak Ridge. No classified material is handled in the course, and

security clearance is not required. The Institute will arrange for passes to admit participants to the Oak Ridge Area. At present, participation is limited to citizens of the United States.

A registration fee of $25.00 is charged each participant. Laboratory coats, gloves and equipment will be furnished.

Participants will be housed in dormitories at a reasonable cost.

UROLOGY AWARD

The American Urological Association offers an annual award of $1,000.00 (first prize of $500.00, second prize $300,00 and third prize $200.00) for essays on the result of some clinical or laboratory research in urology. Competition shall be limited to urologists who have been in such specific practice for not more than five years and to residents in urology in recognized hospitals.

The first prize essay will appear on the program of the forthcoming meeting of the American Urological Association, to be held at the Biltmore Hotel in Los Angeles, May 16–19, 1949.

For full particulars write the Secretary, Dr. Thomas D. Moore, 899 Madison Avenue, Memphis 3, Tennessee. Essays must be in his hands before February 15, 1949.

Committee on Scientific Research
Miley B. Wesson, *Chairman*
Anson L. Clark
John E. Heslin

MEDICAL SYMPOSIUM ON THE CANCER PROBLEM

The American Cancer Society will hold a Medical Symposium on the Cancer Problem at the Hotel Commodore, New York, New York, on November 6 and 7, 1948. The following program will be given:

The Cancer Problem Today:
- Cancer—A World Problem. Charles S. Cameron, M.D.
- Cancer—A National Problem. John R. Heller, Jr., M.D.
- Cancer—A Personal Problem. 1. Are There Dangers in Lay Cancer Propaganda? Daniel A. Blain, M.D., 2. Creating Awareness. Herbert L. Lombard, M.D.

The Problem of Treatment—Recent Advances:
- Diagnosis of Breast Tumors by Radioactive Phosphorus. B. V. A. Low-Beer, M.D.
- Treatment of Diseases of the Hematopoietic System with Artificial Radioactivity. John H. Lawrence, M.D.
- Application of Radioactive Materials in the Management of Thyroid Cancer. Rulon W. Rawson, M.D.
- Castration as a Therapeutic Agent in Cancer of the Male Breast. Norman L. Treves, M.D.
- Hormone Therapy in Cancer of the Female Breast. Ira T. Nathanson, M.D.
- Control of Cancer of the Prostate. Wallace W. Scott, M.D.

Dinner. Speakers: 1. Present Potentials of Radiation Therapy. L. Henry Garland, M.D. 2. What Can We Expect from Atomic Energy? Shields Warren, M.D.

The Lung Cancer Problem:
- Results of Community-Wide Chest X-Ray Programs in Cancer Case Finding. Theodore F. Hilbish, M.D.
- Cytologic Diagnosis of Cancer of the Lung. John R. McDonald, M.D., and Peter A. Herbut, M.D.
- Prospects of Improved Control of Lung Cancer. Alton Ochsner, M.D.

Cancer Research, Cancer Education, and the Cancer Problem in General Medical Practice:
- The Progress in Cancer Research at the National Cancer Institute. Harry Eagle, M.D.
- Present Status and Future Plans of Cancer Education in our Medical Schools. Samuel C. Harvey, M.D.
- The Cancer Problems of a Family Doctor. Maurice T. Root, M.D.

Vol. 60, No. 4

ABSTRACTS OF ROENTGEN AND RADIUM LITERATURE

Department Editor: George M. Wyatt, M.D., 1835 Eye St., N.W., Washington 6, D. C.

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ROENTGEN DIAGNOSIS

NECK AND CHEST

New, Gordon B., Figi, Frederick A., Havens, Fred Z., and Erich, John B. Carcinoma of the larynx; methods and results of treatment. *Surg., Gynec. & Obst.*, Nov., 1947, *85*, 623–629.

The authors express the conviction that carcinoma of the larynx is a curable disease, particularly when diagnosed accurately and early. However, they feel that no one form of therapy is superior to all others in the treatment of this disease. On the contrary, the type of growth in question, its activity, extent, and location and the age and general physical condition of the patient should be the factors which determine what type of treatment should be instituted in each individual case. In general, low grade laryngeal carcinomas should be treated by surgical measures while extensive high grade, radiosensitive tumors require irradiation. Successful surgical therapy for carcinoma of the larynx is not a question of operative technique alone but of the co-ordinated and collective efforts of the surgeon, pathologist, anesthetist, assistants, and nurses.—*Mary Frances Vastine, M.D.*

Schoolman, Joseph G. Mortality in cancer of the larynx. *Ann. Otol., Rhin. & Laryng.*, March, 1948, *57*, 197–200.

The author reviews the experience in laryngeal cancer in the Department of Otolaryngology at the University of Illinois from 1930 to 1946. During this period, 161 cases were diagnosed as cancer of the larynx. Of these, only 40 were considered operable. Total laryngectomy were performed on 20 patients and laryngofissures on 12 patients.

On the basis of statistical analysis, the author expects 82 per cent of the 12 patients having laryngofissure operations to be cured. Again, on the basis of statistical analysis, he expects 55 per cent of the 28 patients having laryngectomies to be cured. When the entire group of 161 patients were judged statistically, only 15.6 per cent of the patients with cancer of the larynx were living and well at the end of five years.

The author examines the histories of the large incurable group of patients in order to determine whether inoperability was due to tumor activity, patient neglect or physician neglect. He decided that in 45 per cent of the cases, patient procrastination was responsible for the inoperability and in 25 per cent of the cases,

medical mismanagement was responsible for the delay. In reviewing the laryngeal biopsies performed, it was noted that malignancies constituted almost 56 per cent of the total laryngeal biopsies. The diagnoses in the remaining 44 per cent included benign conditions such as papilloma, leukoplakia, polyps, etc.

Though but four pages in length, this article contains a wealth of valuable statistical information.—*Philip J. Hodes, M.D.*

Chafton, P., and Maleki, A. Anatomie radiologique du poumon. (Roentgen anatomy of the lung.) *J. de radiol. et d'électrol.*, No. 7–8, 1947, *28*, 285–310.

This splendid monograph on the roentgenological anatomy of the lung was one of the special reports presented at the Fifth Congress of French Speaking Radiologists held in Paris, October 7–11, 1947, under the presidency of Dr. R. Ledoux-Lebard, Electro-Radiologiste Honoraire des Hôpitaux. These twenty-five pages form a beautiful monograph covering (1) the bronchial tree and bronchial vessels, (2) bronchography, (3) tomography and its contribution to the study of the normal roentgen anatomy of the vessels and bronchi of the lung, (4) the pulmonary segments, fissures and lobes. The article is excellently illustrated with roentgenograms plus anatomic drawings, which are very numerous and most helpful from a reference standpoint in the section dealing with the bronchopulmonary segments. The anatomy of segmental lesions is very thoroughly presented.—*William M. Loehr, M.D.*

Taquino, George J., and Joseph, Gerald F. Carcinoma of the esophagus; an analysis of 145 cases with special reference to metastases and extensions. *Ann. Otol., Rhin. & Laryng.*, Dec., 1947, *56*, 1041–1058.

The authors report a series of 145 cases of carcinoma of the esophagus, 124 of which were proved by postmortem examination.

The duration of symptoms ranged from less than a month to eighteen months. The average duration was less than 5½ months.

Dysphagia was almost always the first symptom which brought the patient to his physician. On careful questioning, however, a considerable number of patients recalled that substernal pain and burning after meals had preceded their dysphagia. An even larger group of patients were able to remember that cough had preceded their dysphagia. The authors believe that cough may be an important early symptom in carcinoma of the esophagus which they attribute to diaphragmatic irritation. Indeed, the authors suggest the advisability of esophagography in all patients with a cough whose lungs seem negative. The authors stress the fact that esophagoscopy is not a trivial procedure and when the examination is planned, it should be a complete examination including biopsy if necessary. The evidence clearly indicates that esophagoscopy with biopsy is indicated in every patient who complains of some abnormality on swallowing or of any other abnormal sensation related to the ingestion of food.

Of considerable interest was the fact that in 4 instances, the diagnosis of carcinoma of the esophagus was completely overlooked until autopsy. In the first patient a laparotomy was performed and a diagnosis of primary intra-abdominal cancer was made. The second patient died of cerebral metastasis from carcinoma of the esophagus. The third patient had a lung abscess and autopsy revealed a suppurative process following central necrosis in a metastatic lung tumor. The fourth patient was thought to have a thoracic aneurysm. He had complained of hoarseness for six months and finally died of a hemorrhage. Autopsy revealed the hoarseness to be due to carcinoma of the esophagus and the hemorrhage was the result of extension of the disease into the aorta.

One of the chief reasons why carcinoma of the esophagus is such a highly fatal disease is that its anatomic location in the midst of important and vital structures makes the esophagus a particularly dangerous site for a malignant process. It has no outer serosal covering and it is richly supplied with lymphatics in the submucosal and muscular coats. Because of this, the growth tends to spread longitudinally, to erode through the esophageal walls with mediastinitis, and to metastasize to the regional lymphatics.

Cachexia and inanition were the most common causes of death. The authors believe that unless gastrostomy is performed early while the patient is in relatively good condition, there is little point to performing it at all. They believe it merely prolongs for a short time a life that is not worth the living.

Of the 145 patients with carcinoma of the esophagus, 2 patients who had radical operations were alive when last seen at the end of one year. Six patients in whom radiation therapy had been used were kept alive from nine to eighteen months.

This article contains many very valuable charts obtaining to the various types of metastases from carcinoma of the esophagus. This is an excellent statistical survey.—*Philip J. Hodes, M.D.*

Putney, F. Johnson. Thoracic stomach produced by esophageal hiatus hernia and congenital short esophagus. *Ann. Int. Med.*, June, 1948, *28*, 1094–1105.

Thoracic stomach results from herniation through a normal or abnormal diaphragmatic opening, or failure of development of the esophagus. The diaphragm has only one normal opening through which gastric hernia is apt to occur and that is the esophageal passageway, considered to be the weakest point in the diaphragm.

The condition is divided into traumatic and non-traumatic types and the subdivisions of each are briefly sketched. In most instances of thoracic stomach, the organ gains access to the thoracic cage through the esophageal opening in the diaphragm. The abnormal position may be produced by congenital short esophagus or by one of the two types of acquired hernia through the esophageal hiatus, namely hiatal hernia and paraesophageal hernia. In herniation through the esophageal hiatus the distinction between paraesophageal and true hiatus hernia is that in the former the lower end of the esophagus remains fixed in its normal position and a portion of the stomach herniates through the hiatal ring adjacent to the esophagus, while in the latter type there is protrusion of both the lower end of the esophagus and a portion of the stomach into the thorax. The length of the esophagus affords the main difference between thoracic stomach produced by a short esophagus and herniation through the esophageal hiatus.

Symptomatology is variable and may simulate either singly or in combination those of gastrointestinal, cardiac, respiratory or gallbladder disease. The most persistent and frequent symptom is difficulty in swallowing but occasionally absence of all symptoms may occur. Roentgen examination usually shows this condition most clearly with the patient in the right oblique prone position, when the contrast mixture can be kept in the cardia by gravity. The hiatus appears above the position that the lower end of the esophagus would normally occupy. The "pinchcock" appearance of the hiatus is absent but the esophageal gastric junction can usually be distinguished even though as often occurs in cases of cardioesophageal relaxation it appears as only a slight indentation in the barium column. Simple relaxation of the lower end of the esophagus probably results from weakening of the fibers about the hiatus. Every case in which relaxation is found should be considered a potential case of hiatal hernia.—*Eugene J. McDonald, M.D.*

Paul, R. N. A new anomaly of the aorta. Left aortic arch with right descending aorta. *J. Pediat.*, Jan., 1948, *32*, 19–29.

The author proposes the following classification of aortic arch anomalies:

A. Right aortic arch.
   1. Right aortic arch with right ascending aorta
   2. Right aortic arch with retroesophageal aorta
      a. Left descending aorta
      b. Right descending aorta

B. Double aortic arch
   1. Right arch serving as main channel
   2. Left arch serving as main channel

C. Anomalous subclavian artery
   1. Arising from aortic arch or descending aorta
   2. Arising from a right or left aortic arch

D. Coarctation of the aorta

E. Complete interruption of the isthmus of the aorta

F. Left aortic arch with right descending aorta.

Right aortic arch is to be distinguished from dextroposition of the aorta where the aortic opening overrides the right ventricle and from transposition in which the aorta arises entirely from the right ventricle. In right aortic arch with right descending aorta the fourth right arch persists instead of the fourth left arch. The aorta arises from the left ventricle but passes to the right of the esophagus and trachea, over the right main bronchus and descends on the right side. In 25 per cent of a group of 500 cyanotic children studied by the author a right aortic arch with right-sided aorta was present.

In right aortic arch with retroesophgeal aorta, the aorta arises from the left ventricle, passes to the right of the esophagus and trachea but then turns sharply to the left behind the esophagus, and descends to the left of the spine. In most cases the patients are asymptomatic. The heart is usually otherwise normal. The retroesophageal aorta produces characteristic roentgen changes. Confusion may arise where a double aortic arch is present.

In double aortic arch the right and left aortic arches persist. The right aortic arch is usually

the main vessel and the left arch is represented by a partially or completely obliterated tube. The right arch crosses behind the esophagus as in right aortic arch with retroesophageal aorta. The left arch crosses over the trachea and joins the right arch posteriorly and to the left of the esophagus. The differentiation from right aortic arch with retroesophageal aorta depends upon visualization of the left arch coursing over the trachea in the oblique view. Bilateral indentation of the barium-filled esophagus has been demonstrated. Instillation of lipiodol into the trachea may also demonstrate deformity.

The commonest form of anomaly of the subclavian artery is the one arising from the descending aorta and passing in front of the trachea, between it and the esophagus or behind the esophagus. The latter is the most common and displaces the esophagus anteriorly.

Finally the author discusses a new anomaly, discusses 2 case reports and describes the roentgen appearance. In this condition there is a left aortic arch with a right descending aorta. In the anteroposterior view the barium-filled esophagus is indented on the left side by the aortic arch. However, between the aortic knob and the upper left border of the heart there is an absence of cardiac or vascular shadows to the left of the barium-filled esophagus and the esophagus descends far to the left of the midline. Anterior displacement of the esophagus is also present and demonstrable indicating the retroesophageal course of the aorta. These findings when taken together all indicate the presence of a left-sided aortic arch crossing to the right and descending to the right. In the 2 cases presented a findings were confirmed at operation.—*Rolfe M. Harvey, M.D.*

Vivas-Salas, E. Cardiac aneurysm in a child of seven years of age. *Am. J. Dis. Child.*, Jan., 1948, *75*, 92–99.

A case of ventricular aneurysm in a boy, aged seven, is reported. The electrocardiographic observations similar to those seen in lesions of the wall of the heart pointed to severe myocardial damage.

Three types of aneurysm due to congenital defects of the heart have been described. The first type was described by Abbott as "diverticulum of the heart." This type is of little importance except as a rare pathologic specimen. The second type is thought to be due to an anomaly in the development of the muscle bundles. Only one such case has been described in the literature. The third type that may give rise to cardiac aneurysm is the anomalous origin of the left coronary artery from the pulmonary artery.

The fluoroscopic examination of the heart showed normal diaphragmatic movements. The hilar shadows were somewhat accentuated. The vascular pedicle was normal. The cardiac shadow in the anteroposterior view was increased in size, and an irregular bulge was noticed along the lowermost arc, left border. This bulge was of less density than the rest of the cardiac shadow, had a somewhat ledgelike superior border and showed decided paradoxic pulsations. It expanded in systole when the rest of the heart contracted. This paradoxic pulsation was so pronounced that under the fluoroscopic screen the aneurysmal bulge seemed always to be on the point of bursting. It was impossible to disengage the aneurysmal bulge from the rest of the cardiac shadow with rotation of the patient into various oblique positions.

The author believes that the patient had a cardiac aneurysm, based on roentgenologic evidence and the fact that the electrocardiogram showed evidence of severe myocardial disease. The only possible cause, he believes, was a congenital defect due to either a developmental defect of the muscle bundles of the ventricle or to inadequate nourishment of the ventricular wall caused by the anomalous origin of the left coronary artery from the pulmonary artery. He states that congenital cardiac aneurysm is not necessarily fatal in the first year of life.—*R. S. Bromer, M.D.*

Dickson, Roger W., and Jones, John P. Congenital heart block in an infant with associated multiple congenital cardiac malformations. *Am. J. Dis. Child.*, Jan., 1948, *75*, 81–84.

A case is reported of congenital heart block associated with multiple congenital cardiac anomalies. The congenital anomalies found at autopsy were: transposition of the aorta and the pulmonary artery; absence of the right atrioventricular orifice; septal defect; patent foramen ovale; patent ductus arteriosus; coarctation of the aorta and dilatation and hypertrophy of the left ventricle. This case is regarded by the authors as fulfilling the requirements set forth for the diagnosis of congenital heart block.

The roentgenogram of the chest of the

patient showed an extremely enlarged heart, chiefly to the left. The intrapulmonary vessels were definitely dilated and the aortic knob seemed to be shortened.—*R. S. Bromer, M.D.*

Harvey, W. A. Pulmonary brucellosis. *Ann. Int. Med.*, April, 1948, *28*, 768–781.

Two cases of chronic diffuse pulmonary disease due to brucellosis and a review of the literature are presented. The authors feel that their cases show a characteristic clinical course marked by perihilar lymphadenopathy, bronchitis and pneumonitis of prolonged duration, and usually spontaneous subsidence with resorption or fibrosis. The laboratory findings pertinent to the diagnosis of brucellosis are discussed. In the absence of positive blood culture, it would appear that the diagnosis is not established to general satisfaction unless two of the specific laboratory tests are positive, although there are many published reports in which the diagnosis has been accepted on the basis of the skin test alone, or positive agglutination alone. Beatty is quoted as describing the roentgenological findings as those of hilar infiltration, peribronchial infiltration, thickened pleura, pleural adhesions, and pleural effusion. Harvey's cases show early perihilar and peribronchial infiltration and evidence of persistent fibrotic changes. The difficulty in differential diagnosis from pulmonary tuberculosis is emphasized. Both of these cases were considered to be strongly suspicious of pulmonary tuberculosis. Complete laboratory studies over a prolonged period are recorded. Serial chest films in both cases are reproduced.—*Eugene J. McDonald, M.D.*

Dickie, Helen A., and Clark, Elizabeth A. Histoplasmin and tuberculin sensitivity in relation to pulmonary calcifications among University of Wisconsin students. *Ann. Int. Med.*, June, 1948, *28*, 1087–1093.

The highest incidence of pulmonary calcifications has been found in the central eastern half of the United States. These areas are not closely correlated with the areas of highest mortality from tuberculosis. Because a number of reports have demonstrated that a large number of these individuals had negative tuberculin reactions, a search for a non-tuberculous etiology was started. The authors quote much of the earlier work in histoplasmin sensitivity and present results of a routine survey of 5,000 University of Wisconsin students. These students had photofluorogram and tuberculin tests. One hundred sixty were tuberculin negative, but had pulmonary calcifications. Sixty-six out of 73 who had pulmonary calcifications were histoplasmin positive and tuberculin negative.

Although Wisconsin is an area of comparatively low incidence of histoplasmin sensitivity, the general pattern of the occurrence of pulmonary calcifications is the same as for areas of higher incidence, that is, calcification is two to four times as frequent in the histoplasmin reactor as in the tuberculin reactor. The fact that histoplasmin sensitivity does not necessarily mean that the infective agent is *Histoplasma capsulatum* is well recognized. However the high degree of correlation between histoplasmin reactions and pulmonary calcifications suggests that these calcifications are the result of previous infections with *Histoplasma capsulatum* or a very closely related fungus.

The incidence of pulmonary calcifications of the entire group surveyed and studied was 38.3 per cent in the students reacting only to histoplasmin and 9.2 per cent in those who reacted to tuberculin alone. Small pulmonary infiltrates, indistinguishable roentgenologically from tuberculous lesions, may be associated with histoplasmin sensitivity and not tuberculin sensitivity. In this series coccidioidin skin testing was not done routinely.—*Eugene J. McDonald, M.D.*

Biggs, A. D., and Rigby, R. C. Nontuberculous pulmonary calcification. *J. Pediat.*, April, 1948, *32*, 393–396.

Evidence has accumulated in recent years to disprove the conception that pulmonary calcifications are pathognomonic of tuberculosis. The authors found a group of 14 children in an out-patient department with negative tuberculin tests and pulmonary calcifications. All children were negative to PPD in both first and second test strengths. Bronchoscopic secretions were also negative by direct smear, culture and guinea pig inoculations for tuberculosis.

One patient had acid fast bacilli in aspirated secretions which were attributed to Boeck's sarcoid. All patients showed calcified hilar nodes on roentgen examination and one patient had calcifications in the right third anterior interspace. Six of the 12 patients examined had positive histoplasmin skin reactions. Eight of the 13 patients had changes in the bronchial mucosa.

The authors concluded that tuberculosis is not the only important cause of pulmonary calcifications. Histoplasmosis and recurrent respiratory infections may be other causes.—*Rolfe M. Harvey, M.D.*

Mann, L. T. Spontaneous disappearance of pulmonary metastases after nephrectomy for hypernephroma. *J. Urol.*, April, 1948, *59*, 564–566.

The spontaneous disappearance of metastases in the lungs secondary to hypernephroma is rare. The author summarizes the reported cases and adds that of a sixty-two year old male who complained at the time of hospitalization of progressive weakness, weight loss, and productive cough. Roentgenogram of the chest showed multiple nodular densities varying from 1.4 cm. in diameter. Routine studies to show the source of the primary tumor disclosed a mass lesion of the lower pole of the left kidney by intravenous urography.

The pathological report of the specimen following nephrectomy was hypernephroma. A subsequent film of the chest, seven weeks later, showed more extensive metastases. Eighteen months later a chest film was entirely negative, the metastatic nodules having completely disappeared. The author has no explanation to offer for this.—*Rolfe M. Harvey, M.D.*

Gilbert, R., and Voluter, G. Morphologie radiologique pulmonaire d'un granulome histiocyto-éosinophile de la machoire inférieure et de la calotte cranienne. (Pulmonary roentgen manifestations of an eosinophilic granuloma of the mandible and cranial vault.) *J. de radiol. et d'électrol.*, No. 11–12, 1947, *28*, 465–467.

The authors present a case of eosinophilic granuloma of the mandible and frontal and parietal bones with associated roentgen changes demonstrated in the lung fields. They believe this to be the first instance of parenchymal lung changes associated with eosinophilic granuloma of bone in the world literature. The patient was a Polish Israelite, aged twenty, who had spent most of World War II in a concentration camp. The patient presented himself to the Dental Clinic (University of Geneva) for a localized tumor of the right mandible. Other bone lesions were found in the frontal bone and the postero-inferior portion of one of the parietal bones. The lung changes were discrete miliary, soft lesions, with those in the interior basilar portions resembling "the branches of a fir-tree" by their superposition and their number. The miliary seeding having the character of soft granules of small caliber produced practically no interstitial tissue reaction and no coalescence. The patient had a right pneumothorax of about one-third of the three right lobes at the time of the chest film and the authors assume a possible rupture of a subparietal-pleural lesion. There were no clinical symptoms referable to the lungs—subjectively the pulmonary lesions were completely silent. The authors propose the name "eosinophilic granuloma of the lung" for the roentgenological pulmonary findings in this case.

One must remember that the pulmonary lesions were not examined histopathologically and that the roentgen diagnosis of the chest lesions in this case is by exclusion of other possible causes of soft miliary lesions in a patient with biopsy report of eosinophilic granuloma of bone from the mandible biopsy.—*William M. Loehr, M.D.*

Dickie, H. A. Spontaneous mediastinal emphysema and spontaneous pneumothorax; a report of 20 cases. *Ann. Int. Med.*, March, 1948, *28*, 618–629.

The rapidly increasing number of case reports indicates that spontaneous mediastinal emphysema is not rare. From the University of Wisconsin's Student Health Service, in a four year period, 6 cases of spontaneous pneumothorax without recognized mediastinal emphysema, 7 cases of pneumomediastinum without recognized pneumothorax, and 7 cases in whom the two conditions were associated, are reported. Case summaries of the 14 with mediastinal emphysema are presented. Despite repeated examinations by roentgenograms and fluoroscopy, mediastinal air could be demonstrated in only 3 instances. The clinical diagnosis was made by physical signs of a crunching sound synchronous with the heart beat, along with hyperresonance over the precordium. None of the group showed any physical evidence of subcutaneous air. Inability to demonstrate air in the mediastinum is expected, unless it is localized or relatively large in amount. Only 4 out of the 20 cases were tuberculin positive. One case had roentgen evidence of emphysematous blebs. No roentgenograms are reproduced.

Treatment in this series was symptomatic, and the course was in general benign. With

early ambulation, no complications were reported in the 14 cases of mediastinal emphysema.—*Eugene J. McDonald, M.D.*

ABDOMEN

Strassmann, George S. Relation of acute mucosal hemorrhages and ulcers of gastrointestinal tract to intracranial lesions. *Arch. Neurol. & Psychiat.*, Feb., 1947, *57*, 145–160.

The records of approximately 1,400 autopsies were reviewed in an effort to tell how frequently and under what conditions acute mucosal hemorrhages and erosions of the gastrointestinal tract may be observed with and without fatal intracranial lesions. Twenty-six patients with acute hemorrhagic ulcerations and 30 patients with softenings and perforations of the esophagus, stomach and duodenum are reported. In all but 2, the gastrointestinal lesions were associated with intracranial lesions of various types.

This is a comprehensive article which contains some excellent review of the literature. The author's case histories and photomicrographs support Cushing's contention that erosions and ulcers in the gastrointestinal tract are not infrequently seen in association with various cerebral lesions and after intracranial operations.—*Philip J. Hodes, M.D.*

Schaefer, Arthur A., and Erbes, John. Hypertrophic pyloric stenosis. *Surg., Gynec. & Obst.*, Jan., 1948, *86*, 45–53.

The authors report on 248 cases of pyloric stenosis seen at Milwaukee Children's Hospital. The majority occurred in first-born males. In 9 instances more than one member of a family was affected.

Biopsies show that the longitudinal as well as the circular smooth muscle fibers are hypertrophied.

The diagnosis rests on the symptoms of (1) projectile vomiting, (2) failure to gain weight and (3) scanty stools and the characteristic physical and roentgenographic findings. Visible peristaltic waves are seen in 83 per cent of cases if the examiner takes the trouble to give the patient a drink of water to stimulate the contractions. A pyloric tumor is present in every case and is pathognomonic if found but may be difficult or impossible to feel.

Roentgenologic examination is one of the most important procedures available in the diagnosis and is almost 100 per cent reliable. After a six hour fast the patient is given 2 ounces of formula-barium mixture and observed under the fluoroscope. Roentgenograms are made at five and thirty minutes and at one and two hours if the pyloric canal is not well visualized on the first films. The stenosed pyloric canal casts a typical shadow with a funnel-shaped entrance and a long narrow lumen described respectively as "prepyloric" narrowing and the "string sign." The stomach is lavaged before operation.

Surgical treatment consists of a Fredet-Rammstedt pyloromyotomy using a high right rectus incision so the liver serves to block the intestines from the wound. Preoperative treatment to correct dehydration and routine transfusions of 10 cc. of whole blood per pound of body weight before leaving the operating room are used. Small amounts of water and formula are started one and two hours after operation and the amounts gradually increased until the fifth day when the normal feeding schedule is resumed.

The operative mortality is 3.8 per cent and no death has occurred during the past ten years.—*J. L. Boyer, M.D.*

Baer, P., and Sicher, K. The association of achalasia of the cardia with oesophageal carcinoma. *Brit. J. Radiol.*, Dec., 1947, *20*, 528–532.

The reported incidence of carcinoma of the esophagus associated with achalasia of the cardia varies greatly with various authors. A survey of the available literature reveals only 8 individuals with achalasia who later developed carcinoma of the esophagus. The authors add 1 additional case. The average age of the patients at the time of discovery of the carcinoma is about fifty-five years, and in the usual patient dysphagia begins twenty years previously. Of the 9 patients only 1 was female. The average symptom-free period between treatment of the achalasia and the development of symptoms of esophageal carcinoma is seven years. The subsequent carcinoma develops in the dilated middle third of the esophagus and because of the dilation it may reach a remarkable size before discovery. In some cases the carcinoma may occupy about half the length of the esophagus. Because of the esophageal dilatation none of the patients has marked esophageal obstruction.

The development of the malignancy presumably follows a logical pattern. Stasis of food above the cardia leads to mechanical, thermal

and chemical irritation, eventually producing an esophagitis which, when it is chronic, produces ulceration of the mucous membrane. Reparative attempts produce proliferating papillomatous areas which finally become malignant. Because of this possible sequence of events it would appear advisable to follow patients with esophageal stasis regularly, even in the absence of symptoms.

Both esophagoscopy and roentgen examination are difficult in these patients because of the large amount of retained food, and the esophagus should be carefully emptied. Esophagoscopy is the method of examination which is most reliable in demonstrating the malignancy. The roentgen examination is further hindered by (1) the elongation and tortuosity of the esophagus, (2) the presence of normal esophagus below the lesion which is usually in the middle third, and further by (3) the demonstration of one cause for the patient's symptoms, namely, achalasia. This difficulty exists despite the fact that the involvement with carcinoma is usually quite extensive.

A sixty-eight year old patient is presented who had long-standing achalasia and was symptom free for three years after treatment, and who was seen with a degree of emaciation which could not be explained on the basis of his short history of vomiting. He developed increasing dysphagia for solid food while fluids were tolerated, his vomitus contained a small amount of blood, and he had retrosternal pain. In this individual the extensive carcinoma was well shown by examination with barium.—*E. F. Lang, M.D.*

Grout, J. L. A. Carcinoma of the stomach. Symposium. I. A radiologist's point of view. *Brit. J. Radiol.*, Dec., 1947, 20, 491–501.

This portion of the interesting symposium consists in groups of case histories and roentgenograms illustrating patients with gastric lesions. They are arranged to contrast the various lesions as to roentgenographic and clinical appearance. For example, 2 patients were described, each with an ulcerated greater curvature. From a purely roentgenological point of view, a mass growing on the greater curvature of the stomach with a central ulceration in the mass cannot be classified as to its malignancy. With a long history and such findings as anemia and occult fecal blood a benign tumor is to be suspected; with a short history and without anemia a cancer is more likely. It is sometimes difficult to differentiate between a mass within the stomach and deformity of the stomach from pressure due to an extrinsic mass. In some cases metastatic neoplastic glands outside the stomach may produce more striking roentgen changes than the primary tumor itself which is within the stomach which gave rise to the metastases.

Two cases are presented illustrating the variation in the appearance of the greater curvature. One patient was seen early in the course of a carcinoma of the greater curvature and the irregularity was thought to be normal. A second patient, with less irregularity of the greater curvature but with more prominent symptoms, was re-examined at a shorter interval and the carcinoma was discovered earlier.

It is sometimes difficult to state whether or not a given ulcer is on the basis of a malignancy. A tendency for the mucosal pattern to converge toward the site of the ulcer suggests an innocent ulcer. Irregularity of the mucosa about the ulcer suggests malignancy. Unfortunately, some malignant ulcers improve both symptomatically and roentgenologically under a course of treatment.

Some overemphasis has been placed upon the value of determining whether or not a given portion of the gastric wall participates in a peristaltic wave. It is probable that peristalsis stops at the site of only an advanced lesion, but when waves pass without interruption it does not necessarily mean that there is no neoplasm; also it is occasionally difficult to detect small interruptions in the peristaltic wave.

In a careful roentgen examination of patients with obscure gastric lesions, consideration of the clinical picture is most important and, in some instances, the patient might be considered neglected if there is no actual conference between the patient's physician and the radiologist.

The reproductions of the roentgenograms in this article are excellent and the grouping of the case reports most instructive.—*E. F. Lang, M.D.*

Rodgers, H. W. Symposium. II. Gastroscopy in the diagnosis of gastric cancer. *Brit. J. Radiol.*, Dec., 1947, *20*, 502–504.

Gastroscopy should logically follow roentgen examination in the routine investigation of dyspepsia, and particularly where a carcinoma is suspected, in order to rule out certain important contraindications to gastroscopy. The

roentgen demonstration of an advanced carcinoma makes gastroscopy unnecessary and dangerous with the possibility of perforation. Atrophy of the esophageal mucosa, which may be shown by roentgen ray, does not contraindicate gastroscopy but calls for great care in passage of the instrument.

Gastroscopy is indicated in a patient clinically suspected of having a carcinoma when the roentgen examination either reveals no lesion or shows a lesion the nature of which is obscure. Gastroscopy also aids in classification of a known ulcer as to benignity or malignancy.

Gastroscopically carcinoma may be divided roughly into four categories. The first includes the cauliflower-like projections of polypoid lesions which, if they are large enough to be diagnosed by roentgen ray at all, are usually diagnosed with accuracy. The second type of malignancy is the carcinoma which shows ulceration. This usually has a raised, irregular edge with a sloughing floor and elevation of the whole ulcer above the surrounding mucosa. The third type is the fibrous ulcer with malignant change. These are the most difficult to classify and vary between the ulcer in which malignancy is demonstrated only microscopically to the ulcer which is obviously malignant initially. Here there is irregular hyperemia of the ulcer margin with some irregularity in outline, with areas of nodularity. The floor of the ulcer may contain a blood clot or necrotic tissue and there may be infiltration of the surrounding mucosa with carcinoma. Unfortunately for the diagnosis, this type of lesion frequently improves with bed rest and dietary management, as benign ulcers do. Repeated examination is the most valuable method we have for diagnosis of this type. The fourth type of malignancy is characterized by submucous infiltration such as is characteristically seen in "leather bottle" stomach.

Frequently the gastroscopist adds considerable information by examining a region which is suspicious roentgenologically. Every gastroscopist has had the experience of discovering carcinomas of the stomach, both large and small, which were unsuspected roentgenologically.—*E. F. Lang, M.D.*

Stewart, Matthew J. Symposium. III. Cancer of the stomach: some pathological considerations. *Brit. J. Radiol.*, Dec., 1947, *20*, 505–507.

The presence or absence of malignancy in a given pathological specimen is usually easy to determine. When both an ulcer and a cancer are present the order of development is difficult to determine in many instances. Ulceration frequently develops in a malignancy and usually can be identified as such. In some cases, however, the ulceration spreads from the malignant base to involve the surrounding normal mucosa with the production of the typical microscopic picture of an innocent ulcer. Conversely, it has been demonstrated histologically that simple peptic ulcers of long standing may precede a malignancy at the same site.

Stewart presents information concerning 51 cases of malignancy developing in an ulcer, collected from a series of 733 stomachs which were examined over a period of nineteen years. In each of the typical cases there is a history of at least two years of gastric symptoms which were without interruption and which were marked by an increase in severity. In the patients with malignant degeneration of an ulcer the range of gastric acidity more closely approximates that of simple chronic ulcer than that of primary carcinoma.—*E. F. Lang, M.D.*

Taylor, Hermon. Symposium. IV. The surgical aspect of carcinoma of the stomach. *Brit. J. Radiol.*, Dec., 1947, *20*, 507–511.

Carcinoma of the stomach is in itself a symptomless disease. The important aids in establishing an early diagnosis are radiology and gastroscopy. Very frequently by the time striking symptoms have developed the lesion is inoperable. Achlorhydria usually indicates that the disease has extended and, in one review, one-half of the cases of early operable carcinoma had a considerable quantity of hydrochloric acid in the gastric juice. The test for occult fecal blood is also unreliable in excluding an early lesion. Radiology and gastroscopy often fail to estimate the operability of a gastric lesion and this question can be finally decided only by the surgeon at the time of the operation.

With various surgeons there are different limits to which a malignancy must spread to be considered inoperable. The question of operability depends not only upon the experience and skill of the surgeon but upon his determination to take serious risks if thereby he can give the patient a chance of cure. The author feels that every risk should be taken to extirpate the neoplasm if there are no distant metastases. The surgeon should be prepared to remove the

whole stomach with its omentum, the spleen, the transverse colon, and the tail or body of the pancreas if these are involved in the mass. Although radical surgery of this type increases the surgical mortality rate, it also increases the total number of survivors.

Carcinoma in the cardiac end of the stomach is a problem by itself and diagnosis is even more difficult than in the case of carcinoma in the distal half of the stomach. Diagnosis is difficult even radiologically or by esophagoscopy. For these reasons, if there is reasonable suspicion of a growth of the cardia an exploratory operation is entirely justifiable. Radical surgery is also very important in this field if cures are to be produced.—*E. F. Lang, M.D.*

Fairchild, G. Cranston, and Shorter, Alan. Symposium. V. Irradiation of gastric cancer. *Brit. J. Radiol.*, Dec., 1947, *20*, 511–521.

Today approximately 80 per cent of cases of gastric cancer are inoperable by the time they are seen surgically. Irradiation has been attempted to aid in the treatment. External irradiation fails because of the deep situation of the gastric tumor, the proximity of other vital organs, and high resistance of gastric cancer to irradiation necessitating high doses. Contact roentgen therapy, radon seed implantation, and intracavitary irradiation have also been used.

In 1935 Fairchild conceived the idea of direct irradiation of tumors exposed temporarily at operation. With newer tubes, which deliver up to 2,000 roentgens per minute, the time of exposure is not prohibitive. The dose can be applied directly to the tumor and its field of spread. The size, shape, and extent of the lesion and the presence and direction of spread can be determined at the time of operation, and the skin is left intact for further irradiation if necessary. The direct irradiation may be done at the time of the original operation or may be done after a primary stage at which any existing obstruction was relieved.

The surgical approach to the lesion must be planned to permit the most advantageous positioning of the tube in relation to the patient and the tumor. Two tubes are used simultaneously, one through the incision and another through the posterior abdominal wall. An average tumor dose of 1,300 roentgens is given with a surface dose of 1,300 roentgens from the tube under the patient and 1,600 roentgens from the tube directly over the lesion. Recently the dose from the upper tube has been increased. There have been remarkably few reactions to the irradiation. The patients usually have merely nausea and anorexia, with vomiting and diarrhea only rarely.

In almost three years 15 inoperable carcinomas of the stomach have been treated by direct irradiation. In 7 of these the irradiation was purely palliative. Of the other 8 cases, 2 died within the first week after the operation, 1 lived twenty-four months, 2 fifteen months, 1 seven months, 1 four months and 1 three months after treatment.—*E. F. Lang, M.D.*

Gutman, R. Les duodénites du point de vue radiologique. (Duodenitis from the roentgen viewpoint.) *J. de radiol. et d'électrol.*, 1946, *27*, 65–68.

The author, one of the foremost roentgenologists of the digestive tract, describes again what he believes are quite definite and characteristic fluoroscopic and film images of the inflamed duodenum without ulcer.

Most frequent is a polypoid image, that is to say, the mucosa is strewn with translucent rounded areas lying in denser background. More rarely the image is speckled, the mucosa presenting small opaque flecks. At other times one observes a cloudy aspect due to disappearance of the folds from edema of them. Occasionally duodenitis may manifest itself as a filiform narrowing over part of the length of the duodenum—a spasm resulting from hypertonicity of the muscularis mucosae. These appearances may be diffuse or localized and may be frequently seen to stop sharply at the level of the ampulla of Vater. He states that concerning differential diagnosis from ulcer, the polypoid defects of duodenitis never resemble ulcer deformity and the images characterized by multiple flecks would have "trop de niches"—too many niches—to be confused with ulcer and for the occasional case where small radiating folds converge toward a fleck in an edematous large bulb of duodenitis, the presence of true ulcer can be determined by light compression and repeated roentgen examination.

The author feels that duodenitis can be diagnosed roentgenologically far oftener than it is and that many cases of epigastric distress and pain bear a false clinical label of ulcer when no ulcer can be demonstrated but when signs of an inflamed duodenum are present.—*William M. Loehr, M.D.*

Lepennetier, F., Morin, G., Grain, R., and Siguier. Étude radiologique d'une tumeur bénigne du bulbe duodénal. (Roentgenologic study of a benign tumor of the duodenal bulb.) *J. de radiol. et d'électrol.*, 1946, *27*, 423–425.

The extreme rarity of tumors of the duodenal cap is well known. Very few observations of benign tumor of the duodenum have been published in France. The case described by the authors was a male, aged seventy-eight, who presented absolutely no symptoms referable to the duodenum. The patient entered the hospital for treatment of cardiac asthma and the duodenal lesion was found in the course of a gastrointestinal study which was undertaken in order that the study of the patient would be complete. A polypoid type filling defect was demonstrated at fluoroscopy and spot films (reproduced in the article) demonstrated an ovoid filling defect with regular margins on the left border of the cap. The patient succumbed after about two weeks from his cardiac and pulmonary difficulties and the authors were able to obtain the anatomical specimen which showed a small pedunculated benign polyp about the size of a large pea and fixed to the anterior surface of the bulb. There was no ulceration. The statistical study of benign tumors of the duodenum made by E. Roelsen (*Acta medica Scandinavia*, 1935) is discussed in relation to the authors' case. Roelsen found only 36 cases in the world literature—medical, surgical and radiological—up to 1935. Twenty-nine were verified and included the following: 19 grouped as adenoma, polyp or papilloma, 7 fibromyomas, 1 hemangioma, 1 tuberculoma, and 1 schwannoma and in the series of Roelsen the mucosa covering the benign tumor was ulcerated in 4 cases.

The great rarity of tumor in the duodenal cap quite naturally makes the roentgenologist hesitant about suggesting this diagnosis.—*William M. Loehr, M.D.*

Mahorner, Howard, and Kisner, Wendell. Diverticula of the duodenum and jejunum with a report of a new technical procedure to facilitate their removal and a discussion of their surgical significance. *Surg., Gynec. & Obst.*, Nov., 1947, *85*, 607–622.

Duodenal Diverticula.

Incidence: Duodenal diverticula are found relatively frequently at autopsy. Various investigators have noted their incidence to vary from 0.5 to 14.5 per cent.

Sex: There seems to be no sex predilection.

Location: Most of the duodenal diverticula occur on the concave side of the descending portion. The majority of them occur in the region of the ampulla of Vater. They usually present posteriorly or into the head of the pancreas.

Next to the perivaterian area the concave inferior transverse portion of the duodenum is the site most often affected. The diverticula here present upward and are covered by the transverse mesocolon and are associated with the ligament of Treitz.

Etiology: The condition is seldom seen early in life; it usually occurs in the fifth, sixth or seventh decade.

Symptomatology: It has been estimated that only 25 per cent of duodenal diverticula are asymptomatic. The most common symptom is pain. Apparently the pain is due to filling and failure of adequate emptying of the diverticulum.

Treatment: When duodenal diverticula are large enough to cause residual pooling of barium removal or inversion is indicated.

Jejunal Diverticula.

Jejunal diverticula are much less common than diverticula of the duodenum and much more difficult to diagnose preoperatively. They may cause severe symptoms and surgical removal of them results in cure.—*Mary Frances Vastine, M.D.*

O'Neill, James F., Anderson, Katherine, Bradshaw, Howard H., Lawson, Robert B., and Hightower, Felda. Congenital atresia of the small intestine in the newborn. *Am. J. Dis. Child.*, Feb., 1948, *75*, 214–237.

The types of congenital abnormalities of the alimentary tract considered in this discussion are the complete intrinsic obstructions of the small bowel. Two general groups of such lesions exist: (1) one or more septums or diaphragms completely occluding the lumen and (2) narrowing of the intestinal diameter at one or more sites to the point of total obstruction. In the latter type, the proximal blind end of bowel may be completely separated from its distal counterpart, or the two ends may be joined with a solid cordlike structure, devoid of a lumen. Therefore, mesenteric defects may or may not occur.

The paper contains a report of 2 cases, with a

review of successfully treated obstructions of the small intestine. Under separate headings the following subjects are discussed: the incidence of gastrointestinal atresia, the occurrence of multiple atresias, the incidence of associated deformities of other organs, the familial tendency to intestinal atresias, etiologic theories of the diagnosis of congenital obstruction of the small intestine, the survival time in cases of untreated atresia, and the mortality rates following surgical correction of atresia. In the final portion of the paper the authors discuss and record the cases of successfully treated congenital atresia of the small intestine and report 2 additional cases of their own.

The importance of congenital atresia of the small intestine is much greater than the incidence of the condition would tend to indicate because it is so amenable to surgical treatment. In most children the atretic lesion is the only abnormality present, so that its correction should restore the patient to complete normality.

The nature and location of the opaque areas seen on the preoperative plain roentgenograms of both patients reported are of great interest, in view of Neuhauser's opinion that such areas are typical of the presence of fetal meconium peritonitis. In both infants, a diagnosis of meconium peritonitis could not be made with certainty, for even though the second patient had peritoneal adhesions present, no yellowish plaques of old meconium were present on the peritoneal surfaces. Furthermore, these calcified areas were not present on plain roentgenograms made four days after either operation. It seems probable that in the 2 patients the calcified material was within the intestinal lumen, although this is not entirely certain.

The authors suggest that the high mortality still current even among infants in the hands of excellent pediatricians and pediatric surgeons is due to the fact that many of these patients do not reach them until relatively late in the course of the disease.—*R. S. Bromer, M.D.*

GYNECOLOGY AND OBSTETRICS

Allen, E. Peter. Standardised radiological pelvimetry. IV. Interpretation of pelvimetry. *Brit. J. Radiol.*, May, 1947, *20*, 205–228.

The ability to measure the maternal pelvis by roentgen methods has been perfected to such a degree that it is a reliable means of obtaining the exact bony measurements. The fetal skull cannot be measured so accurately, and its other characteristics, such as compressibility, ability to rotate, and variation in soft tissues, make prediction of the course of labor from roentgen studies still a matter of judgment. By correlating the course of labor with certain features of the pelvis, as shown in roentgenograms, one should be able to arrive at a basis for prediction.

A series of pelves was measured and the course of the subsequent labor was followed with careful notation of factors such as fetal size, length of the three stages, the condition of the child after delivery, and in the case of surgical intervention, whether this was done because of mechanical disproportion or some other factors. The measurements were grouped according to whether or not delivery through that pelvis was normal or abnormal.

As might be expected, the true conjugate was the most useful single diameter in predicting the course of labor. On the other hand, the area of the inlet, or the area of the midplane of the pelvis each permitted more accuracy in prediction than any single diameter. The figures arrived at through an analysis of many cases indicate when a normal delivery is to be expected. These figures should be used for prediction when the child is of average size and when there is no other factor which might indicate abnormality other than mechanical obstruction. With a small baby delivery might occur through a pelvis which would be called abnormal in other circumstances. For the figures arrived at here the average fetal skull is taken as 100 mm. in diameter, and variations from this should alter the prognosis.

Vaginal delivery is predicted as certain when the conjugate is over 130 mm., or when the brim area is over 130 sq. cm. Cesarean section is considered justified when the conjugate is under 90 mm. and the brim area is under 85 sq. cm.—*E. F. Lang, M.D.*

Hartnett, Leo J. The possible significance of arterial visualization in the diagnosis of placenta praevia. *Am. J. Obst. & Gynec.*, June, 1948, *55*, 940–952.

The author performed aortograms on 68 women during the later stages of pregnancy without serious complications.

Sodium iodide, 80 per cent, and diodrast, 70 per cent, were used in this series. The patients were routinely carefully checked for sensitivity to the contrast substance before the procedure was carried out.

The puncture of the aorta was performed on the roentgen table. With the patient lying prone under intravenous pentothal sodium anesthesia, the aorta was punctured and the contrast medium injected. As a rule, 10 cc. of sodium iodide or at least 18 cc. of diodrast were injected into the aorta within a period of about five seconds. Sodium iodide seemed to cause considerable irritation of the arterial bed with contraction of the uterus. The latter were not observed when the sodium iodide was injected more slowly or when diodrast was used. The first exposure was made as the injection was completed and the second within seven seconds of the first.

Extravasation of the injected solution was one of the more common complications occurring in 13 of the 68 women injected. This was followed by some lumbar pain and a slight febrile reaction which lasted for one or two days.

Visualization of the placenta was excellent. The maternal circulation was clearly defined. The placenta was characterized by the appearance of multiple collections of the radiopaque substance irregularly distributed throughout one portion of the uterus. Instead of the usual appearance of blood vessels, there were many large lake-like collections which the author refers to as "mottling."

Two patients with bleeding were studied by this technique and, in both, a placenta previa was encountered.

This is an interesting article which contains seven excellent illustrations showing the apparatus and the resulting roentgenograms.—*Philip J. Hodes, M.D.*

Sun, Ko-Chi. The characteristics in hysterosalpingograms in tuberculous salpingitis and endometritis. *Am. J. Obst. & Gynec.*, June, 1948, *55*, 953–960.

The present observations are based upon the author's findings in 6 patients who proved to have tuberculous salpingitis and endometritis at operation.

Three distinct and constant features were found in all of the patients examined by hysterosalpingography.

First, the lipiodol revealed defective nonhomogeneous filling of the cervical canal and uterus. The lipiodol in the cervical canal revealed a fuzzy contour, whereas its outline was shaggy and irregular in the uterus.

Second, the fallopian tubes appeared like thin, stiff wires with irregular sacculations near the fimbria. The fimbria were pouch-like and saccular. Not infrequently the contrast medium appeared uneven simulating radiopaque foreign bodies.

In the third place, lipiodol never appeared free in the peritoneal cavity.

Excellent roentgenograms document this communication. In addition, the author briefly reviews the differential diagnosis of hysterosalpingograms.—*Philip J. Hodes, M.D.*

GENITOURINARY SYSTEM

Coliez, Robert. Les signes radiologiques de stase et de suppression urétero-rénale au cours de l'urographie intra-veineuse. (Roentgen signs of stasis and ureterorenal suppression during intravenous urography.) *J. de radiol. et d'électrol.*, No. 7–8, 1947, *28*, 311–342.

The second report presented before the Fifth Congress of French Speaking Radiologists is a masterful presentation of all diagnostic aspects of intravenous urography complete to the minutest detail, from the nature of renal elimination of contrast substances to every type of characteristic pyelographic deformity due to urinary stasis which can be demonstrated by this method.—*William M. Loehr, M.D.*

Herbst, W. P., and Bagley, C. E. Observations on the use of inositol in advanced malignancy of the genito-urinary tract. *J. Urol.*, April, 1948, *59*, 595–598.

Inositol is an experimental compound from the vitamin B complex group. It is normally found in plant and animal cells. It exists in several forms. The compound is stable, water soluble and has a sweet taste. Considerable experimental work has been done on the various forms of inositol in varied conditions.

Seven cases of terminal malignancy of the genitourinary tract were given inositol in doses of 2–4 grams daily. The drug had no effect on these cases, which included carcinoma of the prostate, carcinoma of the penis, and seminoma of the testicle. The drug was then tried in 5 cases of carcinoma of the bladder and some benefit was noted in control of hematuria and reduction in tumor size. The drug also appeared to be beneficial in a case of hypernephroma of the kidney.—*Rolfe M. Harvey, M.D.*

Schmidlapp, C. J., II, and Marshall, V. F. The detection of cancer cells in the urine; a clinical appraisal of the Papanicolaou method. *J. Urol.*, April, 1948, *59*, 599–603.

The Papanicolaou vaginal smear method has been useful in detecting cancer of the vagina, cervix and uterus. The test depends on the exfoliation of tumor cells. The authors have applied the method to the urinary tract. Their present series of cases now includes 333 patients. They found the method to be valueless in benign tumors whose cells did not deviate from the normal sufficiently to make their recognition possible. In the case of malignant tumors, smears from the first urine sediment examined were usually positive although in some cases numerous examinations were required.

Dr. Papanicolaou personally examined all smears. The cases were grouped into clinically cancerous, clinically suspicious and clinically non-cancerous. The laboratory reports were rendered as laboratory cancerous, laboratory suspicious and laboratory non-cancerous.

One hundred ninety-eight cases were reported laboratory non-cancerous, of which 88 per cent were clinically non-cancerous, 4.1 per cent clinically suspicious and 7.1 per cent clinically cancerous. All of the latter group were proved cancerous.

Fifty-three cases were laboratory suspicious; 45.3 per cent of these were clinically cancerous, most of these having positive biopsies.

Eighty-two cases were laboratory cancerous; 86.5 per cent of these were clinically cancerous and one additional 8 clinically suspicious. There has been no instance of a false positive report. In 3 cases, bladder cancers, which had not been suspected clinically, were found after thorough investigation following a positive laboratory report.

This study indicated that the Papanicolaou smear method was of most value in cases of bladder cancer. Care must be exercised in reporting abnormal cells where a cancer patient is receiving hormonal therapy. The finding of malignant cells after all visible cancer has been removed probably indicates residual disease and has prognostic significance.—*Rolfe M. Harvey, M.D.*

Chute, R., and Williams, D. W. Experiences with stained smears of cells exfoliated in the urine in the diagnosis of cancer of the genito-urinary tract; a preliminary report. *J. Urol.*, April, 1948, *59*, 604–618.

The present study was undertaken with a view to determining the possible value of the Papanicolaou stained smear method in detection of malignancy as a possible screening test for mass survey work. The authors made a single modification of Papanicolaou's method by centrifuging an entire fresh specimen of urine and then fixing the sediment with 95 per cent alcohol.

Experience in examining the slides is essential. In the present series the authors insisted on a definite diagnosis based on tissue examination or adequate clinical grounds. The slides were scored as positive, doubtful, or negative. One hundred ninety-four specimens from 168 different cases were considered as satisfactory for the examination; 109 had no malignant disease and 88 per cent were correctly diagnosed negative and 12 per cent incorrectly called positive.

In 59 patients with malignancy of the genitourinary tract 55 per cent were correctly diagnosed by the smear method. In the entire series 77 per cent were correctly diagnosed either positive or negative. The authors found that the more malignant the tumor as far as the bladder was concerned, the more apt it was to be diagnosed by the smear method. This did not hold true for prostatic cancer.

In explanation of the 12 per cent false positives the authors feel that increased experience may help to prevent some of the errors. Apparently chronic inflammatory disease of the genitourinary tract may produce transitional epithelial cells.

The fact that multiple smears are frequently required for a diagnosis militates against the use of the method for mass screening.—*Rolfe M. Harvey, M.D.*

Hickel, R. Les signes radiologiques des tumeurs rénales bénignes et malignes. (Roentgenological signs of benign and malignant tumors of the kidney.) *J. de radiol. et d'électrol.*, No. 3–4, 1947, *28*, 94–103.

The author gives a complete essay on the different abnormal images of the kidney and deformations in the pyelogram characteristic of the most common benign and malignant kidney tumors. The illustrative pyelograms are excellent and there are 16 black and white drawings diagramming pyelographic deformities resulting from different locations of tumors

within the kidney. This is an excellent reference article for teaching.—*William M. Loehr, M.D.*

Campbell, M. F. Bilateral embryonal adenomyosarcoma of the kidney (Wilms' tumor). *J. Urol.*, April, 1948, *59*, 567–571.

Most cases of bilateral Wilms' tumor are not true primary lesions but represent metastases from a single primary to the opposite kidney. True bilateral primary Wilms' tumors are a rarity. The author reports 2 such cases.

The first patient was an eighteen month old infant in whom a left-sided abdominal mass had been discovered. An intravenous urogram confirmed the presence of a left-sided abdominal tumor mass with no identifiable excretion of dye from the left kidney. The right kidney showed compression of the upper and middle calices. No function could be demonstrated from the left kidney after complete urological investigation. Bilateral retrograde pyelography confirmed the findings in the right kidney and showed no demonstrable left kidney pelvis or upper ureter. The preoperative diagnosis was polycystic disease.

At operation it was immediately apparent that the left kidney was the site of a tumor and not polycystic disease. A left nephrectomy was performed. The pathological diagnosis was Wilms' tumor. Three weeks after operation the right kidney was explored and also found to be the site of a malignant tumor. Postoperative roentgen therapy was ineffective.

The second case was diagnosed at postmortem on a twenty-four day old infant dying of inanition.—*Rolfe M. Harvey, M.D.*

Kretschmer, H. L. Renal rickets and polycystic disease of the kidney. *J. Urol.*, May, 1948, *59*, 773–783.

Primary or secondary renal disease leading to prolonged renal dysfunction may result in rachitic bone changes.

The author reports the case of a five month old infant in whom abdominal examination disclosed the presence of a bilateral palpable mass. The child had taken cod liver oil and tomato juice since the age of three weeks. The blood pressure on admission was 180/90. Roentgen studies of the long bones were negative. An intravenous pyelogram showed no visualization of the genitourinary tract. The heart was enlarged. A preoperative diagnosis of polycystic disease of the kidneys was made, and confirmed by operation and biopsy.

Approximately three years later the child showed definite evidence of dwarfism and clinical evidence of rickets. Roentgen examination showed osteoporosis, thinning of the cortices and "deformity" of the metaphyses. The roentgen changes were said to be "not that of infantile rickets."

Among the theories proposed to explain the syndrome called variously renal rickets, renal dwarfism, renal infantilism, and so forth, are the following:

1. Renal theory. In advanced renal destruction the kidneys cannot excrete waste phosphorus. This phosphorus is excreted then through the intestinal mucosa. This interferes with calcium absorption and leads to depletion of bone calcium.

2. Parathyroid theory. Some authors feel that the syndrome is a result of primary hyperparathyroidism and the kidney condition is due to secondary calcification and fibrosis in the kidneys. The distinction between primary hyperparathyroidism and renal rickets depends upon whether or not skeletal changes antedate or follow renal changes. Some experimental evidence exists that renal insufficiency leads to secondary hyperplasia of the parathyroids.

3. Pituitary-diencephalon theory. This theory best explains the dwarfism, infantilism and polyuria.

4. Acidosis. This theory would explain all changes on a basis of chronic acidosis resulting from renal insufficiency.—*Rolfe M. Harvey, M.D.*

Hoffman, H. A. Massive hydronephrosis. *J. Urol.*, May, 1948, *59*, 784–794.

Statistics indicate that the diagnosis of massive hydronephrosis is missed in approximately 1 out of every 3 cases. The commonest confusing condition is ovarian cyst. Only 89 cases of massive hydronephrosis had been reported up to 1947. The author feels that the condition is much more common than this would suggest and found 10 cases in a review of the case records of the Massachusetts General Hospital from 1941–1946, inclusive. He arbitrarily makes the diagnosis of massive hydronephrosis when the capacity of the kidney exceeds 1,000 cc.

The author summarizes his 10 case reports, including illustrative films. In his series males were affected in the ratio of 4:1 as compared with females.

The commonest complaint was flank or loin pain. Fifty per cent had palpable masses. Six of the 10 cases had negative urine sediment. The intravenous pyelograms were valueless in all but one case. The retrograde pyelograms were diagnostic in 9 of the 10 cases. In this series the left side was involved in 90 per cent of the cases.

The referring physician had not made the diagnosis in a single instance. Nephrectomy was the treatment employed in all cases.

Massive hydronephrosis is usually congenital in origin. Infection usually prevents the hydronephrosis from becoming massive by directing attention to the condition. Uncomplicated massive hydronephrosis is usually asymptomatic and many cases rupture following abdominal trauma as the presenting symptom. This leads to an erroneous diagnosis of intra-abdominal injury, laparotomy and a mortality rate of 30 per cent. This emphasizes the importance of considering massive hydronephrosis as a differential possibility and thus avoiding improper therapy and unncessarily high mortality. In the author's series, where the correct diagnosis was made preoperatively and the correct therapy employed, there was no mortality.—*Rolfe M. Harvey, M.D.*

Higgins, C. C., and Hausfeld, K. F. Cutaneous metastases from vesical carcinoma of the urinary bladder; report of two cases. *J. Urol.*, May, 1948, *59*, 879–886.

Skin metastases from vesical carcinoma are rare. The greatest primary source of skin metastases, with a 16 per cent incidence, is breast cancer. The authors have been able to find only 8 reported cases of bladder carcinoma with skin metastases. They report an additional 2 cases.

The mechanism of the metastases is not known but is thought to be by the blood stream to the skin lymphatics. The authors feel that there must be more unreported cases and make a plea for their publication for better evaluation of bladder carcinoma and its therapy.—*Rolfe M. Harvey, M.D.*

Hovenanian, Michael S., and Deming, Clyde L. The heterologous growth of cancer of the human prostate. *Surg., Gynec. & Obst.*, Jan., 1948, *86*, 29–35.

The authors present the results of transplantation of carcinoma of the human prostate into the eyes of guinea pigs. They were able to grow the tumor successfully and make successive transplants for six serial generations. Throughout all of these the cellular morphology of the parent human tumor was maintained, thus proving this cancer to be truly an autonomous growth.

Testosterone or one of its constituents appears essential to the growth of prostatic cancer, for successful "takes" occurred only in normal male animals or in females stimulated with testosterone in tremendous dosage. Transplants failed to grow in castrated males and in normal females. Increasing the amount of testosterone in the males did not increase the rate of tumor growth.

The inherent ability of the prostatic cancer cells to produce acid phosphatase disappeared on transfer as demonstrated by an absence of elevation of blood phosphatase in the tumor-bearing animals and absence of stain for phosphatase in tissue sections.—*J. L. Boyer, M.D.*

Wear, J. B., and Schoenberger, A. P. Carcinoma of the prostate; a twelve year review. *J. Urol.*, April, 1948, *59*, 587–594.

This report is based on a study of 400 cases of prostatic carcinoma seen during a twelve year period; 170 cases had metastases when first seen. The symptoms, physical findings and methods of treatment are all summarized in this report through a series of charts.

Roentgen treatment was used in 54 cases. In 25 cases it was the only form of treatment. The average survival time in these 25 cases was eleven months. Roentgen radiation was never used as a curative procedure. In 50 per cent of the cases roentgen therapy improved the pain of metastatic lesions, for varying periods of time.

The authors state that roentgen therapy will have only a minor role in this disease in their practice in the future, estrogens and orchiectomy having priority. Up to 80 per cent of cases in this series showed favorable response to estrogenic therapy. Orchiectomy is used only in patients with objective evidence of metastases.—*Rolfe M. Harvey, M.D.*

Lewis, L. C. Testis tumors; report on 250 cases. *J. Urol.*, April, 1948, *59*, 763–772.

The authors report on a series of 250 cases of testicular tumors seen at the Walter Reed Hospital. Forty-three per cent had metastases on admission and an additional 28 per cent developed metastases eventually.

The author suggests the following classification of testicular tumors based on embryonal form, pathological structure, radiosensitivity and results of combined surgical and radiation treatment:

A. Tumors of supporting tissues of testis
   1. Cysts of tunica albuginea
   2. Fibromas
   3. Fibrosarcomas
   4. Fibroleiomyosarcomas
   5. Hemangiomas
   6. Endotheliomas
B. Tumors of interstitial cells
C. Tumors of germ cell origin
   1. Seminomas (dysgerminoma, spermatocytoma)
   2. Carcinoma
      a. undifferentiated carcinoma
      b. adenocarcinoma
      c. papillary adenocarcinoma
   3. Trophocarcinoma
      a. choriocarcinoma (form of cytotrophoblast)
      b. chorioepithelioma (form of syncytiotrophoblast)
   4. Teratocarcinoma
      a. teratoma with carcinoma, undifferentiated, adenopapillary
      b. teratoma with choriocarcinoma
      c. teratoma with chorioepithelioma
   5. Teratoma
      a. immature
      b. mature
      c. rhabdomyosarcoma

Group A, tumors of the supporting tissues, are similar to those produced in other parts of the body. Group B, the specific endocrine tumors, are usually benign. The seminoma is histopathologically identical to the ovarian carcinoma. It is slow growing, has delayed metastases, is very sensitive, and has a good prognosis. Forty-three per cent of the tumors in this series were of this variety. Fifteen per cent of this group had metastases on admission. This is the common tumor of the atrophic testicle.

The author states that the lethal dose for mature teratoma cannot be reached with safety by roentgen irradiation.

The symptoms for all tumor groups consist early of painless swelling which may become painful later. Symptoms referable to metastases may be present

The diagnosis is based on bimanual palpation, roentgen examination and, if there is still doubt, by exploration.

The author favors radical orchiectomy for any type of testis tumor. The main exception might be the very radiosensitive seminoma. Radical orchiectomy consists in removing the testis with its tunica, the epididymis, vas, entire spermatic cord and the retroperitoneal lymph nodes from the inguinal ring to the renal pedicles.

The author found roentgen therapy to be effective only if a full lethal dose was used.

No difficulty was encountered in giving a lethal dose with the million volt unit, but care must be exercised for the normal overlying skin. Fourteen patients in this series had perforations of the bowel or stomach, eighteen to twenty-four months following therapy. A lethal dose for seminomas is 1,000 r. Prophylactic irradiation for tumors requiring more than 3,000 r lethal tumor dose is not safe.

Thirty-two per cent of the total series have died, 8 having died from perforation of the bowel or stomach due to excessive irradiation.

The author concludes that simple orchiectomy is sufficient for benign interstitial tumors; radical orchiectomy without roentgen therapy is required for teratomas; simple orchiectomy plus roentgen therapy with 1,000 r delivered to the retroperitoneal nodes is sufficient for seminomas; radical orchiectomy plus prophylactic roentgen therapy up to 3,000 r is required for undifferentiated carcinoma, adenocarcinoma and papillary adenocarcinoma; and, for trophoblastic tumors, radical orchiectomy plus heavy roentgen therapy, when inoperable metastatic nodes remain, should be used.—*Rolfe M. Harvey M.D.*

NERVOUS SYSTEM

Cross, Glen O. Subarachnoid cervical angioma with cutaneous hemangioma of a corresponding metamere. *Arch. Neurol. & Psychiat.*, Sept., 1947, *58*, 359–366.

The importance of recognizing that a relationship may exist between developmental anomalies of the skin and coexisting abnormalities of other ectodermal derivatives is emphasized by this author. The literature obtaining to cutaneous angiomas, lipomas, and vascular tumors associated with similar spinal cord lesions is reviewed. Concerning vascular tumors, the author quotes Cushing and Bajley who pointed out that the skin and other organs lying in the same segment of nerve distribution may often be affected when a vascular abnormality of the central nervous system exists. The fact that patients with nevi of the face may have

associated intracranial vascular tumors is recalled to mind.

The author reports his findings in a patient with a hemangioma of the skin of the left side of the neck and prominent vascular markings of the skin of the upper part of the chest who developed pain, motor weakness and paralysis due to an extensive subarachnoid angioma in the lower cervical spine. The vascular tumor extended from the lower cervical region up into the posterior fossa of the skull. The vessels contained mixed arterial and venous blood. The cord appeared compressed and flattened. The larger blood vessels seemed continuous with the vessels in the spinal cord. The tumor could not be removed but the symptoms regressed following the decompression.—*Philip J. Hodes, M.D.*

French, J. Douglas. Recurrent arachnoiditis in the dorsal spinal region. *Arch. Neurol. & Psychiat.*, Aug., 1947, *58*, 200–206.

The author presents 4 cases selected from 8 cases of dorsal arachnoiditis in whom the diagnosis was verified at operation twice.

The clinical course of spinal arachnoiditis seems to be characterized by an exacerbation and remission of symptoms. Neurologic residua are noted later suggesting a chronic progressive process. The first patient suffered periods of pain, numbness and incomplete paralysis on five different occasions during a period of nineteen years. With time, the attacks became more severe and associated with persistent disability. During one remission, the spinal fluid protein remained markedly elevated for about twelve days whereas seven years later, during another attack, the spinal fluid protein was normal. This patient's myelogram revealed no abnormalities and the patient was not operated upon.

The second patient had many attacks of arachnoiditis over a period of fourteen years, supposedly associated with repeated pulmonary infections. In this patient, too, the spinal fluid protein was found increased during several attacks. A myelogram revealed a partial block in the upper dorsal region which at operation proved to be due to cystic arachnoiditis. This patient improved following surgery.

The symptoms in the third patient were of but two months' duration. This individual, a diabetic, also suffered pain, numbness, weakness and altered reflexes. During the acute phase of his illness, the spinal fluid protein was 400 mg. whereas three days later, it dropped to 100 mg. and a week later, 15 mg., coincident with the patient's improvement. A recurrence of symptoms several weeks later was again associated with a marked rise in the spinal fluid protein to 600 mg. A myelogram revealed marked irregularity and fragmentation of the pantopaque column in the mid-dorsal region. At operation, the arachnoid was found thickened and adherent to an atrophic appearing spinal cord.

The history in the fourth patient also indicated an acute exacerbation and remission of spinal arachnoiditis eleven years after operation for an epidural abscess. This patient's spinal fluid protein was also markedly elevated to 375 mg. A myelogram revealed a complete block at the level of the first lumbar vertebra. Improvement was spontaneous and the patient was not operated upon.

The evidence suggests that spinal arachnoiditis is an acute recurring process which becomes chronic only when organized adhesions or cysts have formed, producing irreversible changes in the spinal cord. Changes in subarachnoid pressure and in the chemical content of the spinal fluid appear to follow promptly these fluctuations in symptoms.—*Philip J. Hodes, M.D.*

Adams, Raymond D., and Wegner, Walter. Congenital cyst of the spinal meninges as cause of intermittent compression of the spinal cord. *Arch. Neurol. & Psychiat.*, July, 1947, *58*, 57–69.

The author describes 2 unusual patients with intermittent compression of the spinal cord due to a teratomatous cyst in the meninges. The first patient had suffered five attacks of pain in the back and partial paraplegia with sensory loss and sphincteric disorder. The second patient had also had five attacks of pain in the neck followed by hemiplegia or quadriplegia, sensory impairment, paralysis of the bladder and rectum and respiratory embarrassment. The first patient's illness covered a period of thirteen years while the second patient's symptoms occurred intermittently during a period of six years.

The cerebral spinal fluid protein was increased in both patients. In one patient, a definite dynamic block was demonstrated in the spinal canal.

Both patients were operated upon and in one,

the cyst was partially removed and in the second, it was completely removed with excellent therapeutic results. Microscopic examination of the cysts demonstrated their teratomatous character.

The long history with intermittent periods of compression of the spinal cord characterized this lesion. The evidence suggests that the intermittent character of the symptoms may be the result of intermittent swelling of the cyst with compression of the spinal cord.

Both patients revealed spinal cord blocks by pantopaque myelography. Sharply defined filling defects in the oil column characterized their roentgen appearance. Some thinning of the laminas of the affected segments of the spine was noted at operation in one patient.—*Philip J. Hodes, M.D.*

Lipin, Theodore, and Davison, Charles. Metastases of uterine carcinoma to the central nervous system. *Arch. Neurol. & Psychiat.*, Feb., 1947, *57*, 186–198.

Metastases from carcinoma of the uterus to the central nervous system are infrequent. When present, they may be solitary lesions or they may occur associated with widespread metastatic disease.

The authors report 3 patients with metastatic brain tumors from adenocarcinomas of the fundus of the uterus.

The first patient developed her metastatic brain lesion one year following her hysterectomy. There was no other evidence of malignant disease in this patient.

The second patient developed a cerebellar metastatic nodule five years after her original hysterectomy. This patient had evidence of disseminated carcinomatosis from a uterine malignancy.

The third patient also developed her brain metastasis five years following surgery. She too revealed evidence of disseminated metastatic disease.

The percentage of uterine carcinomas metastasizing to the central nervous system varies from 0.1 to 3.4 per cent according to different authors. The authors believe that neurosurgery is definitely indicated in patients with metastatic carcinoma of the brain if the metastasis is apparently solitary.—*Philip J. Hodes, M.D.*

Gillespie, H. W. Further observations on the radiological diagnosis of lumbar intervertebral disc lesions. *Brit. J. Radiol.*, Jan., 1947, *20*, 37–40.

A previous communication has shown the use of myelography unnecessary in the diagnosis of a prolapsed lumbar intervertebral disc, as the diagnosis can be established by clinical observations and by plain roentgenograms. The two principal findings are decreased intervertebral spacing and hypertrophic fringe formation. In over 50 per cent of cases of disc lesions narrowing of the involved space can be demonstrated.

An attempt has been made to determine how early a decreased intervertebral disc space can be shown after a traumatic episode. There are two ways to show this. A comparison of preoperative and postoperative roentgen studies when some disc material has been removed shows further decrease in the spacing as early as four weeks after laminectomy.

The second method is estimation of the interval between the onset of pain and the time of roentgen demonstration of the decreased space. In a series of 100 patients 70 per cent were able to give not only the date of onset of the pain but the cause. Twenty-five per cent gave no history of injury but could state the onset of sudden pain. All 100 patients in this series were subjected to operation on the basis of clinical and roentgenographic findings, and in 92 the operative findings corresponded with the preoperative roentgen findings.

The time interval between the onset of pain and roentgen evidence of decreased intervertebral disc spacing varied between one month and twenty-seven years. In 16 of the 92 cases there was a time interval of five months or less.—*E. F. Lang, M.D.*

SKELETAL SYSTEM

Pyle, S. Idell; Mann, Arvin W.; Dreizen, Samuel; Kelly, Harriet J.; Macy, Icie G., and Spies, Tom D. A substitute for skeletal age (Todd) for clinical use; the red graph method. *J. Pediat.*, Feb., 1948, *32*, 125–136.

The red graph method is a graphic means of expressing skeletal development. The name is derived from the color graph paper used in constructing the original graph. The graph was composed during the revision of Todd's "Atlas of Skeletal Maturation." The red graph method differs from the Todd graph in that the latter averages development of the various bones of a skeletal unit and expresses this average in the

form of a single line chart whereas the red graph method plots zones including the earliest and most advanced bone age represented in a skeletal unit. The red graph method thus will better express the developmental symmetry of a functional skeletal unit.

Todd's original standard was based on the fact that bone growth consists of a series of histological changes in cells whereby bone salts are modelled into cortex. Both the Todd and red graph methods consist of a series of roentgenograms to portray the successive steps, or skeletal maturity indicators, through which the articular cortex of the bone and the epiphyseal cartilage plate progress to form adult bone joints. The speed of these changes is a measure of the child's growth.

The reason for development of the red graph method as a refinement of the Todd graph is that the Todd graph is an average and discounts the development of the most delayed bones obscuring the site of tissue strength and weakness. By use of the red graph the assigned age of every bone will fall within the zone of the graph.

The authors include graphs of 3 children to illustrate how the red graph is constructed and its practical clinical employment.—*Rolfe M. Harvey, M.D.*

Shuman, H.H. Infantile cortical hyperostosis. *J. Pediat.*, Feb., 1948, *32*, 195–202.

The author reports an additional case of the syndrome originally described by Caffey. His patient was a four months old male infant who was admitted to the hospital for fever, irritability and brawny facial edema. The patient had had adequate nutrition and had been in good health prior to the onset of the present illness. Ten days before admission he developed what appeared to be a typical upper respiratory tract infection with fever, irritability and rhinitis. The day before admission a bilateral brawny swelling of the lower jaws developed.

Penicillin and sulfadiazine did not affect the course of the disease. An elimination diet was also tried without avail. Roentgen studies of the mandibles on admission were negative. After four weeks a tender swelling appeared over the left clavicle. Roentgenograms at this time showed typical changes in both clavicles, several ribs and both mandibles. There was no evidence of pleural effusion. Illustrative films are included.

Subsequent studies showed gradual improvement in the bone lesions although fever persisted for six months. No etiological agent was discovered.

The author calls attention to the fact that the child's growth was uninterrupted throughout the course of the disease.

The characteristic roentgen changes consist of external cortical thickening of the affected bones, which may or may not be laminated, and extends the whole length of the bone shaft. Involvement of the mandibles is almost a prerequisite for the diagnosis.—*Rolfe M. Harvey, M.D.*

Herdner. Le sternum de l'enfant. Frequence actuelle de troubles de développement révélés par l'examen radiographique. (The infant sternum; present incidence of disturbance of development revealed by roentgen examination.) *J. de radiol. et d'électrol.*, No. 9–10, 1947, *28*, 387–393.

The author points out the high frequency of developmental disturbances seen in the ossification centers and later in the asymmetric development of the manubrium and body of the sternum in children studied during 1946. The author considers the sternum a "test bone" for study of growth and development. Abnormalities in size, shape and contour of the manubrium and segments of the body of the sternum of varying degrees are discussed and illustrated. In many instances in the author's cases the changes were first picked up on chest films of infants and young children.—*William M. Loehr, M.D.*

Smith, Frederick M. Monteggia fractures; an analysis of twenty-five consecutive fresh injuries. *Surg., Gynec. & Obst.*, Nov., 1947, *85*, 630–640.

In 1814 Monteggia was the first surgeon to describe 2 cases of fracture of the shaft of the ulna associated with which there was an anterior dislocation of the head of the radius. This combination of injuries has since been commonly called a Monteggia fracture.

Though not a common one the injury is also not a rarity, yet it might seem so if one were to count only the fresh cases that come to the clinic for treatment. It is an extremely important type of injury because of the fact that the true diagnosis is often completely missed on clinical and even on roentgen examinations. To over-

look the associated radial head dislocation results in inadequate treatment, continued dislocation, possible ugly and permanent deformity, loss of lateral stability at the elbow, restriction of function, and oftentimes pain.

Summary.

1. Early recognition of the radial head dislocation is the most important part of the diagnosis in Monteggia fractures.

2. Early treatment with completely perfect reduction of the fracture as well as the dislocation is necessary and this must be checked frequently by roentgenograms to rule out secondary loss of position of either bone.

3. Open reduction is frequently necessary if the ulnar fragments cannot be held in anatomical position.

4. Open reduction is often absolutely necessary to make possible reduction of the radial head and for removal of interposed ligament or capsule.

5. If open reduction is to be performed, it should be done early and preferably with rigid internal fixation applied to the ulna.—*Mary Frances Vastine, M.D.*

Hughes, E. S. R. Painful heels in children. *Surg., Gynec. & Obst.*, Jan., 1948, *86*, 64–68.

The author takes issue with the diagnosis of osteochondrosis of the epiphysis of the os calcis in painful heels in children. The roentgenographic signs usually taken to indicate epiphysitis such as enlargement of the epiphysis, irregularity, fluffy appearance, etc., as well as several abnormal appearances of the epiphyseal line and the metaphysis of the os calcis are explained on the basis of the development of the bone and its normal variants.

This study of the roentgenograms of 39 painful adolescent heels in conjunction with the normal series fails to show evidence of epiphysitis or osteochondrosis. Also, follow-up examinations revealed no residual anatomical abnormalities. The author concludes that there is insufficient proof that osteochondrosis is ever the underlying cause of adolescent painful heels.—*J. L. Boyer, M.D.*

Abeshouse, B. S. Heterotopic bone formation following suprapubic prostatectomy. *J. Urol.*, Jan., 1948, *59*, 50–66.

The author classifies extraskeletal heterotopic bone formation as follows:

1. Periosteal type (involvement of bone without soft tissue extension).

2. Fascial type (primary involvement of fascial tissues with subsequent involvement of adjacent muscle tissues but no demonstrable bone connection).

3. Muscular type (involvement limited to muscles with no demonstrable bone connection).

4. Combined form (the most frequent).

Few reports of heterotopic bone formation following abdominal operations exist and still fewer reports following suprapubic operations on the bladder and prostate. The author was able to find only 17 case reports of the latter in the literature.

It has been experimentally demonstrated by Strauss and others that the epithelium of the upper urinary tract has unusual osteogenetic properties. The chief histopathological changes consist of the development of an epithelial-lined cyst in twenty days and bone formation in sixty days. Heterotopic bone formation of this experimental type is supposedly due to metaplasia of the proliferating epithelium and surrounding connective tissue. Other theories offered as to the occurrence of heterotopic bone formation following suprapubic prostatectomy include neurogenic, metabolic, chemical irritation, neoplastic, traumatic, inflammatory and periosteal. The author favors the metaplastic theory.

The heterotopic bone may be found superficially in small masses or more deeply in the fascial coverings of the rectus muscle and may or may not be attached to the symphysis pubis. The bone masses may be single or multiple. Usually the bone is true cancellous bone.

The masses may be asymptomatic or the patient may complain of pain and functional urinary disturbances. Usually a firm or stony hard mass can be palpated in the region of the operative scar.

The diagnosis is made on the history of a preceding operation, palpation of a mass and roentgenograms of the pubic area. The latter may show a tumor of bone density, the relationship to the pubis being demonstrable by stereoscopic anteroposterior, lateral or oblique views.

The differential diagnosis must include foreign bodies, osteitis of the pubis, hematoma, of the muscles, malignancy of the pubis, faulty healing of pubic fractures, congenital skin osteoma and calcification or ossification in malignant tumors.

The treatment is surgical excision. No recur-

rences have been reported. The author includes the eighteenth reported case with a roentgenogram to show the typical roentgen appearance. —*Rolfe M. Harvey, M.D.*

ROENTGEN AND RADIUM THERAPY

Figi, Frederick A. Hemangiomas of the mouth. *Ann. Otol., Rhin. & Laryng.*, Dec., 1947, *56*, 853–866.

This is a very satisfactory review of hemangiomas of the mouth which includes comments concerning their pathology, physical characteristics, and treatment.

The strawberry type of capillary hemangioma is lined with an infantile form of endothelium because of which these growths respond well to irradiation. The author prefers a screened radium plaque.

Because the blood vessels in port wine stains are lined with an adult type of endothelium, these lesions are not benefited by roentgen therapy. The author advises the use of cosmetics to conceal the blemish.

Cavernous hemangiomas respond well to irradiation. The author uses radon seeds containing from 0.25 to 0.1 millicurie each implanted into the tumor and spaced approximately 1 cm. apart. Roentgen therapy or radium packs are used to supplement the interstitial irradiation. In adults, however, cavernous lesions are more effectively treated with electrocoagulation or an injection of boiling water or chemical sclerosing agents. The plexiform or racemose hemangiomas are more difficult to obliterate than the simple cavernous hemangiomas because of the greater amount of blood coursing to the part. Though more common in adults, these lesions occur frequently in infants. Early in life, interstitial irradiation has been used effectively. In adults, lesions of this type with only a slight impulse are often treated with electrocoagulation. Usually, these lesions require ligation of the afferent vessels in addition to the usual measures employed in the treatment of cavernous hemangiomas.

Hemangiomas about the jaws often contain phleboliths which may cause considerable discomfort. These calculi are easily palpable and may be removed with surprisingly little bleeding.—*Philip J. Hodes, M.D.*

Gilbert, René. La roentgenthérapie de la douleur. (Roentgen therapy of pain.) *J. de radiol. et d'électrol.* No. 7–8, 1947, *28*, 343–353.

The author discusses the use of roentgen therapy in the treatment of pain and devotes considerable space to a study of the mode of action of roentgen radiation on pain. Use of roentgen radiation in treating pain is divided into following categories: (1) treatment of pain in cases in which cause of the pain is known—inflammations, acute or chronic, neoplasms, vasomotor disturbances, and (2) treatment of pain in cases in which the cause is unknown, for example neuralgias or so-called essential neuralgias. Each type and subtype of clinical cause of pain is discussed from the point of view of therapy factors used to obtain an analgesic effect. Of interest is a table of results obtained in treating sciatic neuralgia with the rays directed at different segments of the spine from T10 to L3 only, T10–L3 plus L4–S2, L4–S2 only, T10–L3 plus peripheral distribution of sciatic, T10–L3 plus L4–S2 plus periphery, and peripheral distribution of sciatic only. Sixty-eight per cent of cases were cured when treatment was directed through T10–L3 only. Only 2 cases were relieved by directing through L4–S3 only. Field size of 17 by 8 cm. on each side of midline of spine at level of T10–L3 and rays directed obliquely inward at angle of 20 to 25°; 160 kv. (peak), 0.5 mm. Cu plus 1 mm., Al, distance 40 cm., 3 treatments per week, 6–8 treatments total; dose per treatment 125 r (in air on skin), total of 1,500 to 2,000 r for each region irradiated.—*William M. Loehr, M.D.*

Hahn, P. F., and Sheppard, C. W. The therapeutic use of radioactive elements in malignancy. *Ann. Int. Med.*, March, 1948, *28*, 598–606.

Isotopes offer much promise in solving the mysteries of metabolic processes in the animal and human body. The authors state that artificially produced radioactive isotopes have opened up such broad horizons in the treatment of malignant disease that they will ultimately in all likelihood far surpass roentgen and radium treatment together in therapy.

Criteria for therapeutic usefulness of radioactive isotopes are cited and include (1) a desirable half-life ranging from two to ten days; (2) biological behavior of the isotope and chemistry of the element should be established and understood; (3) the radiation spectrum should be established and proper cognizance of the rela-

tive beta and gamma radiation which it is desired to deliver to tissue must be taken into account; (4) the radioactive material should preferentially be deposited selectively in the tissues it is desired to treat; (5) if the isotope is toxic, specific activity becomes important in keeping the dosage of material well under toxic limits.

From Seaborg's table of some 450 known radioactive isotopes, a small group are selected for discussion, with the criteria predicated above being the limiting factors. The most striking observation is the paucity of isotopes which hold promise of use as therapeutic agents. Radioactive sodium, phosphorus, manganese, copper, arsenic, yttrium, silver, iodine, and gold are briefly discussed. Suggested techniques in therapeutic use are outlined.

Some of the author's techniques have been given clinical trial, and have shown themselves to be feasible. A few are sufficiently controversial that they require considerable additional analysis.—*Eugene J. McDonald, M.D.*

Huggins, Charles. The chemotherapy of cancer. Editorial. *Surg., Gynec. & Obst.*, Nov., 1947, *85*, 660–662.

At this time it is possible to notice only those chemical methods of treatment which seem to have been well established. They may be divided into 3 groups according to their action.

1. Necrotizing agents. It has long been known that certain bacterial products when administered parenterally to creatures bearing sarcomas produce severe hemorrhage in the tumors within a few hours with subsequent necrosis of the affected area of the neoplasm. The separation of the hemorrhage producing agent in a culture of *Serratia marcescens* (*Bacillus prodigiosus*) from toxic and inert contaminates has been accomplished by Shear and co-workers in a brilliant series of investigations; it has been found to be a polysaccharide which is active in very small amount. Unfortunately, in most cases the necrosis of the tumor is not complete and while certain tumors regress, some of the tumor usually remains viable.

2. Competitive inhibition and the essential foodstuffs. It has been found in cancer of the prostate that androgen is often an essential item for the nutrition of the malignant cell; the tumors grow vigorously when androgen is administered in appropriate dosage and the cells tend to wither when the androgen supply is removed (orchiectomy) or estrogen is administered.

Heilman and Kendall found that the compound E of Kendall derived from the adrenal cortex caused massive involution of lymphosarcomas in female and young male mice. There seems to be a relationship between the adrenal cortex and lymphocytes in that adrenal stimulation causes a decreased activity of lymphoid tissue.

Sulfonamides in proper concentrations have been found to eliminate the effectiveness of p-aminobenzoic acid, a substance essential for the growth of certain bacteria.

3. Nuclear damage. It has long been established that irradiation damages cells, and because of the frequency of induced mutations as well as much other evidence, the principal effect of irradiation is believed to be on the nucleic acids of the cell nucleus. The radioactive isotopes with a short period of decay constitute a useful method of presenting soluble radioactive chemicals to the organism as a whole. Radioactive phosphorus has great value in chronic lymphatic and myelogenous leukemias and is probably the best therapeutic agent which is now available for polycythemia vera.

The nitrogen mustards have been used in clinical patients in the treatment of Hodgkin's disease and it has been found that regression sometimes occurs after their use. The mustards are the only agents known which can produce mutations chemically, an effect which hitherto has been produced only by radiant energy.

Still another agent capable of producing regressions in cancer is ethyl carbamate (urethane) which has produced regression of transcarcinoma in mice as well as in human leukemia. Urethane can reduce the growth of human prostatic cancer notably in patients where a relapse has occurred after hormonal treatment with orchiectomy and estrogen; the drug is not antiandrogenic and so constitutes a new principle in the treatment of advanced prostatic cancer acting by pycnosis.—*Mary Frances Vastine, M.D.*